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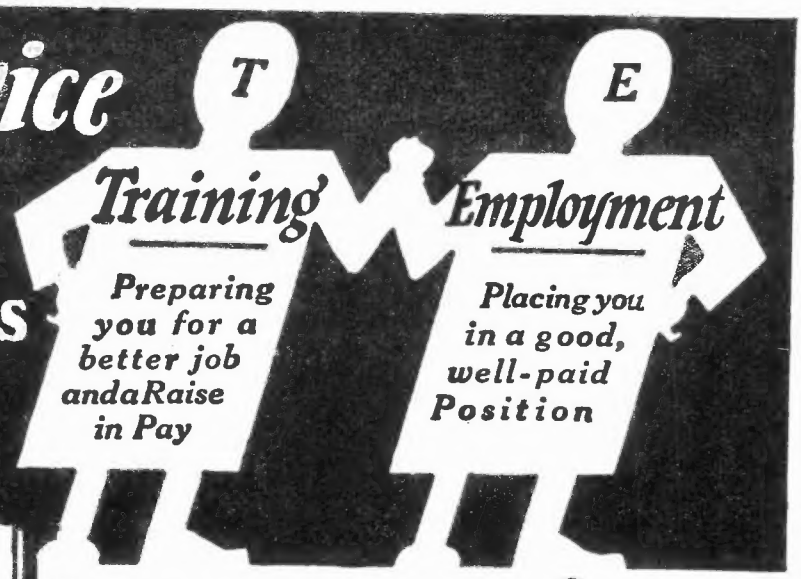

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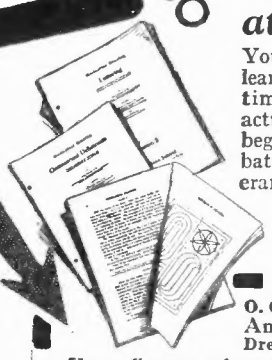

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IN OCTOBER ISSUE

Planes Steered Through Fog

The new devices used to steer airplanes through fog and storm will be described in this article.

Making Movie Film

The complete procedure used in making movie picture film from the raw materials.

Perpetual Motion Exposé

A new and baffling invention which closely approached "perpetual motion" is exposed in this article.

Recaning Chairs

If you have any old chairs that need recaning, you will be able to do this by following the instructions.

Human Nutrition Problems

Experiments on the problems of correct nutrition will be described in this article.

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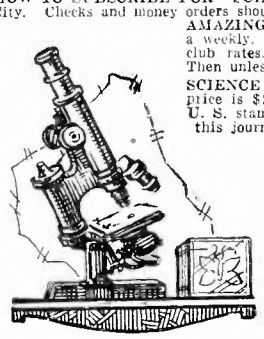

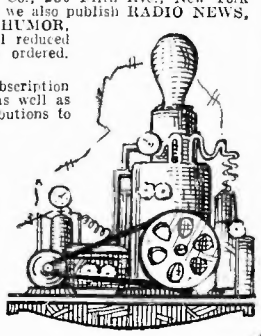

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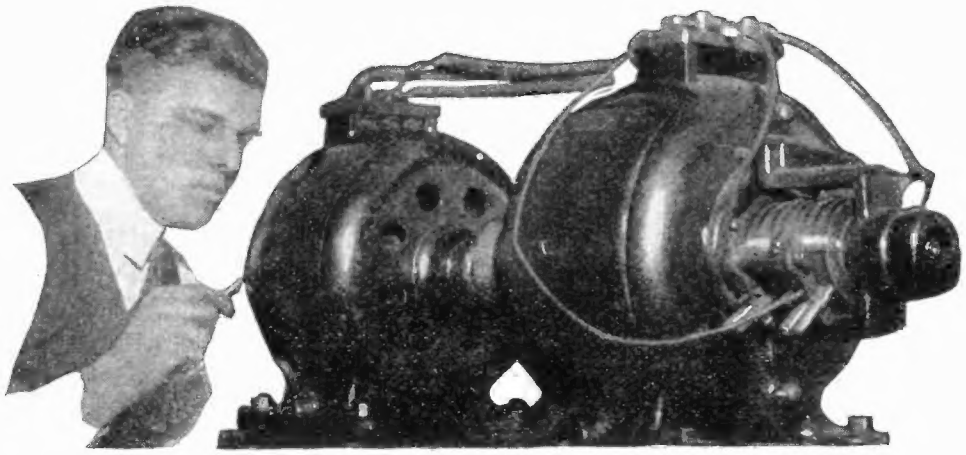

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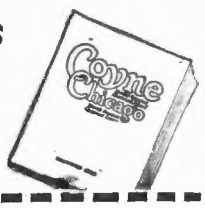

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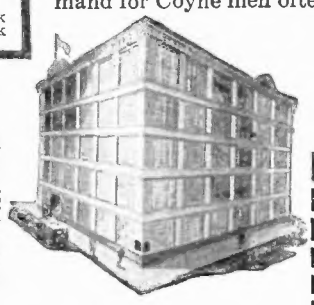

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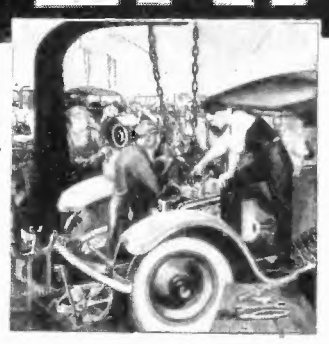

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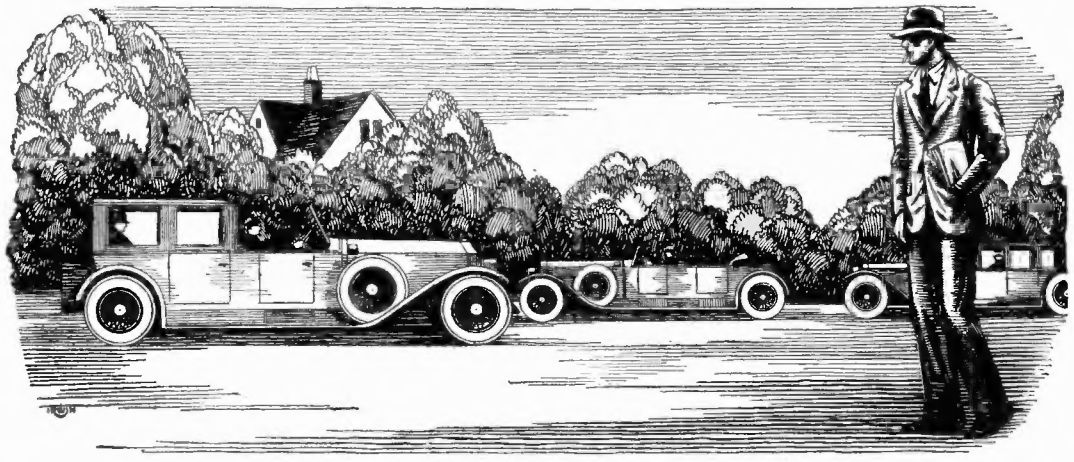

Many times in the old days, while I trudged home after work to save carfare, I used to gaze enviously at the shining cars gliding by me, the prosperous men and women within. Little did I think that inside of a year, I, too, should have my own car, a decent bank account, the good things of life that make it worth living.

I Thought Success Was For Others

Believe It Or Not, Just Twelve Months Ago I Was Next Thing To "Down-and-Out"

TODAY I'm sole owner of the fastest growing Radio store in town. And I'm on good terms with my banker, too—not like the old days only a year ago, when often I didn't have one dollar to knock against another in my pocket. My wife and I live in the snuggest little home you ever saw, right in one of the best neighborhoods. And to think that a year ago I used to dodge the landlady when she came to collect the rent for the little bedroom I called "home"!

It all seems like a dream now, as I look back over the past twelve short months, and think how discouraged I was then, at the "end of a blind alley." I thought I never had had a good chance in my life, and I thought I never would have one. But it was waking up that I needed, and here's the story of how I got it.

I WAS a clerk, working at the usual miserable salary such jobs pay. Somehow I'd never found any way to get into a line where I could make good money.

Other fellows seemed to find opportunities. But—much as I wanted the good things that go with success and a decent income—all the really well-paid vacancies I ever heard of seemed to be out of my line—to call for some kind of knowledge I didn't have.

And I wanted to get married. A fine situation, wasn't it? Mary would have agreed to try it—but it wouldn't have been fair to her.

Mary had told me, "You can't get ahead where you are. Why don't you get into another line of work, somewhere that you can advance?"

"That's fine, Mary," I replied, "but *what* line? I've always got my eyes open for a better job, but I never seem to hear of a really good job that I can handle." Mary didn't seem to be satisfied with the answer, but I didn't know what else to tell her.

It was on the way home that night that I stopped off in the neighborhood drug store, where I overheard a scrap of conversation about myself. A few burning words that were the cause of the turning point in my life!

With a hot flush of shame I turned and left the store, and walked rapidly home. So that was what my neighbors—the people who knew me best—really thought of me!

"Bargain counter sheik—look how that suit fits," one fellow had said in a low voice. "Bet he hasn't got a dollar in those pockets." "Oh, it's just 'Useless' Anderson," said another. "He's got a wish-bone where his backbone ought to be."

As I thought over the words in deep humiliation, a sudden thought made me catch my breath. Why had Mary been so dissatisfied with my answer that "I hadn't had a chance?" *Did Mary secretly think that too?* And after all, wasn't it *true* that I had a "wish-bone" where my back-bone ought to be? Wasn't that why I never had a "chance" to get ahead? It was true, only too true—and it had taken this cruel blow to my self-esteem to make me see it.

With a new determination I thumbed the pages of a magazine on the table, searching for an advertisement that I'd seen many times but passed up without thinking, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

WHAT'S happened in the twelve months since that day, as I've already told you, seems almost like a dream to me now. For ten of those twelve months, *I've had a Radio business of my own!* At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business—such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing "I never had a chance!"

NOW I'm making real money. I drive a good-looking car of my own. Mary and I don't own the house in full yet, but I've made a substantial down payment, and I'm not straining myself any to meet the installments.

Here's a real tip. You may not be as bad off as I was. But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you'd better be *doing* something about it instead of drifting.

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Take another tip—No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free, and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Dept. KD-6, Washington, D. C.

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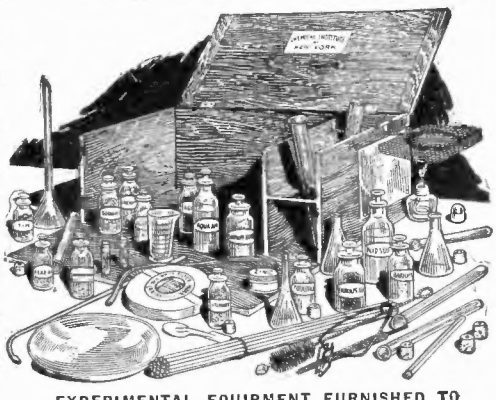

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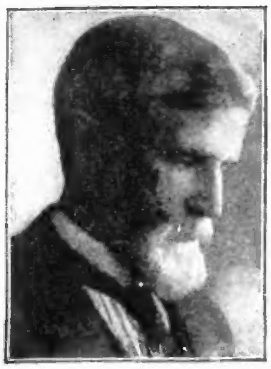

T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D

Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

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GREETINGS!!

FRENCH HUMOR
NO HARM DONE
—Madame n'est pas superstitieuse?
—Mais non
—Je suis bien contente, je viens de casser la grande glace du salon!
"Madame isn't superstitious, I hope?"
"Good Lord, no"
"That's good. I just broke the big mirror in the parlor."
Helpfull Hints
—Ciel du porto sur ma robe! Comment faire pour la détacher?
—La . . . sur le côté . . . ces petites aspirines . . .
"Heavens! Some port wine on my dress! How on earth can I take it off?"
"Right there . . . on the side . . . those little knocks"
The Safest Way
THE Count Louis of Canosse, a Roman, owned some beautiful silverware. There were several pieces of the most marvelous craftsmanship. He had, among others, a goblet which was shaped like a tiger—and which was most skillfully carved.
One day a friend of his borrowed this goblet with the intention of having a copy made. But he kept it more than six months and the count had to send for it.
Some time after that, this same gentleman sent his page over to borrow a salt-shaker which was shaped like a lobster. But then the count answered with a bantering smile:
"Tell your master that if the tiger, the fleetest of animals, took six months to come back, I'm afraid that the lobster, which is much slower, will never come back. So he'll be kind enough to let me keep it."
A KNOCKOUT
—Tu es dans un triste état, mon pauvre vieux!
—T'en fais pas, je suis vainqueur!
—Eh bien! je voudrais voir la figure du vaincu!
"You're in a sad state, old man!"
"Don't worry, I am the winner!"
"Well! I should like to see the face of the loser!"

French Humor gives the readers of this book the first confidential view of a sample page direct from the first issue.

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Volume XV
Whole No. 173

Science and Invention

September, 1927
No. 5

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR SLOANE, PH.D., *Associate Editor*
Editorial and General Offices, - - - 230 Fifth Avenue, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

TWENTY YEARS HENCE

By HUGO GERNSBACK

IT is always a risky thing to make predictions of what will or will not happen in the future. I hope that I may be pardoned for pointing out that a number of my long range predictions have actually come to pass. For instance, in the year 1910, in my book, "The Wireless Telephone," the first one of that name ever published anywhere, I made certain predictions as to when we would have the wireless telephone, which then was not in existence.

In 1909 I was the first one to use the word "Television," and wrote a number of articles on the subject, outlining my belief as to when it would come about. All of these predictions have come true, as we well know now.

The following reflections, therefore, in the light of what has gone before, may appear somewhat wild to present day readers, but probably will be vindicated.

Within twenty years there will be far more airplanes in the air than we have cars on the ground now. There will be a great exodus from the city to the country, not a movement back to the farm, but, most likely, a movement back to the home. Inaccessible and practically valueless plots in the most out of the way places will bring high prices for house building sites, because hills and mountain tops will be more accessible than the valleys.

I do not see the airplane, as it is today, neither do I see the helicopter as the final solution for aircraft. As long as an airplane requires a landing field, or at least, a space for a runway of 100 yards, or more, to either alight or take off, airplanes will not come into universal use. The helicopter idea, to my mind, is not sound. The chances are that we shall have an airplane that will be able to land on rooftops, or even in streets, if necessary. I believe that airplanes will be *articulated* in such a way that the entire plane can be spun around practically within its own length, and kept on circling in this small space as long as necessary. This would be the equivalent of "standing still," for an automobile. If a landing were to be made, the airplane could then spiral down by gradually losing altitude. It could rise the same way, always spiralling in a small circle, which need not exceed 50 feet in diameter, and perhaps even a great deal less for smaller machines.

I firmly believe that within twenty years air-liners of a special construction will make the trip from New York to Paris within ten to twelve hours at a maximum, flying through the upper strata of our atmosphere. The flying would be done at tremendously high altitudes, for the simple reason that here there is less air resistance, with a consequent increase in speed and safety. The entire hull for passengers and crew would be practically airtight, as the space would have to be supplied with air at proper pressure, and, due to the tremendous cold at high altitudes, the inside would have to be heated artifically as well, either from the exhaust of the engines, or electrically.

I believe that within twenty years it will be possible to actually send power wirelessly; that is, without the need of intervening pipes or wires. It will only be possible, at first, to send sufficient power to a land or air vehicle to light and heat it, the power being supplied entirely or in part from the ground.

In twenty years universal television will be an everyday affair. It will be possible to talk over the telephone to your friend a thousand miles away and see him at the selfsame time. The same thing will be true in radio, where you will see what is being broadcast at all times. Television still holds some great surprises for us, and the applications in television may well revolutionize our entire mode of living, just as the telephone has revolutionized it.

It is quite probable that within twenty years, two of man's greatest scourges, tuberculosis and cancer, will have been done away with entirely, or else they will be controlled in such a manner as to no longer be called dangerous. These two diseases will be conquered just exactly as diabetes has already been conquered during the past few years.

Electrification of crops will be an established fact twenty years hence. There is no reason why the ground can not yield twice as much produce, as has long been shown experimentally. The equipment to double and triple crops by using constant electric currents in the ground where the crops are planted, is not at all expensive, and is easy to tend and harness. As the population increases we must have more vegetable food-stuffs. Electrified crops is the answer to the problem. Incidentally, it will make farming highly profitable, for the reason that a small area will yield a triple or even a quadruple crop.

The average length of man's life has been increased from about 40 to 60 years since the middle ages. Man can expect to live much longer as times goes on, due to better personal hygiene, better sanitation, and better understanding of the human machine. I confidently predict that the present average of 60 years will be raised at least five, and perhaps as much as ten years, by the end of the next twenty years.

On the other hand, infant mortality, which has been greatly reduced during the last fifty years, will be reduced still further. There is no reason at all for most infantile diseases. We are slowly conquering them, one by one, and I believe that most of them such as measles, diphtheria, scarlet fever, rickets and others will probably have been done away with twenty years hence.

Twenty years hence, weather control will no longer be a theory. While it may take longer than this to actually have universal weather control, within twenty years it will be possible to at least cause rain, when required over cities and farm lands, by electrical means. But we shall not solve the problem of warding off or creating cold and heat in the open for many centuries.

Within twenty years our private dwellings and office buildings will be artificially cooled, the same as they are heated in the winter time. There is no good engineering reason why we should have to swelter and cut down our production in the summer time, any more than we should freeze in the winter. The present hot water and steam piping systems will probably be used for the artificial cold circulation.

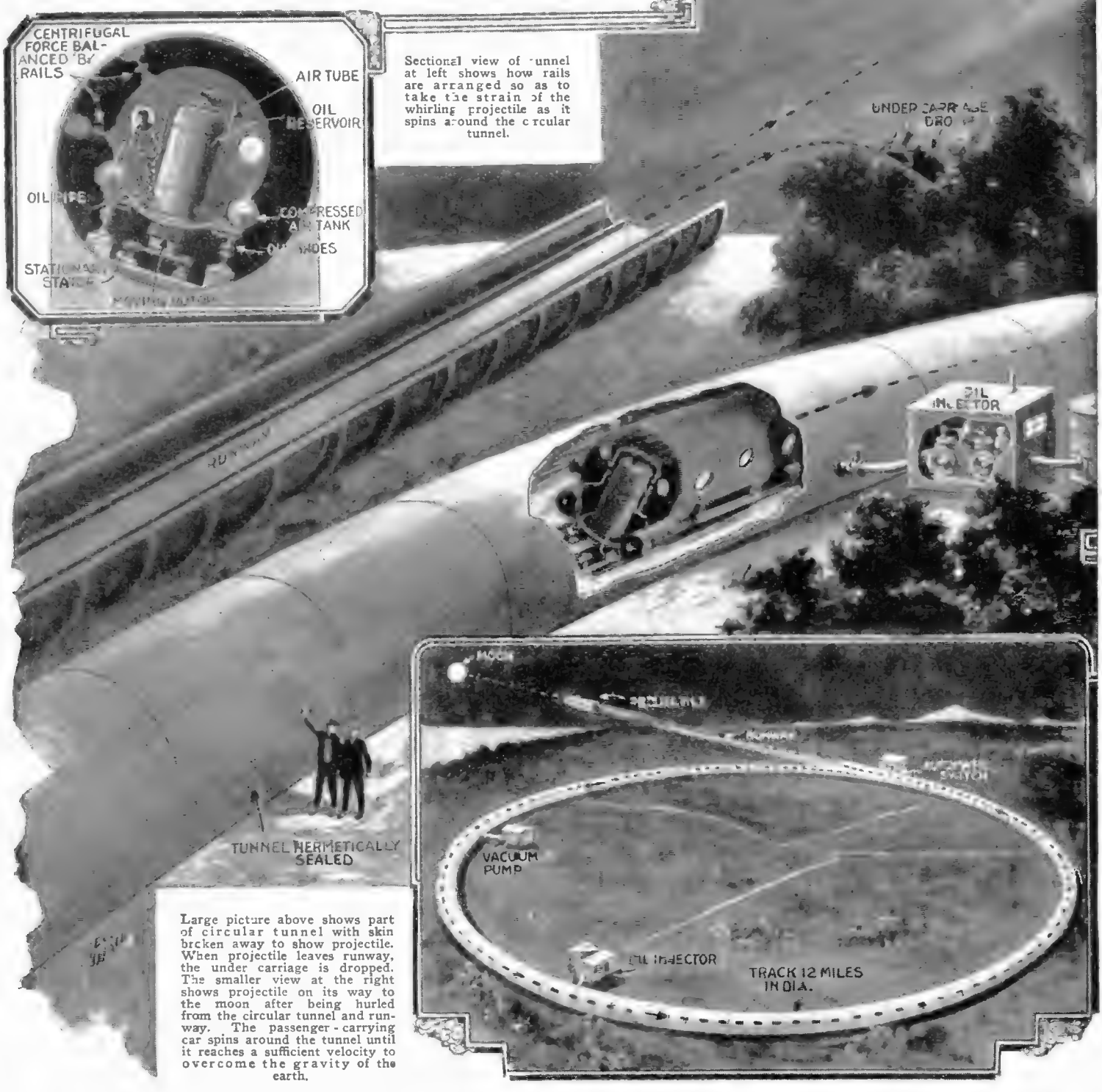
Mr. Hugo Gernsback speaks every Tuesday at 9 P. M. from Station WRNY on various scientific and radio subjects.

TO THE MOON VIA TUNNEL

Passenger-carrying Projectile is Propelled Around Tunnel to Gain Sufficient Velocity to Leave the Earth

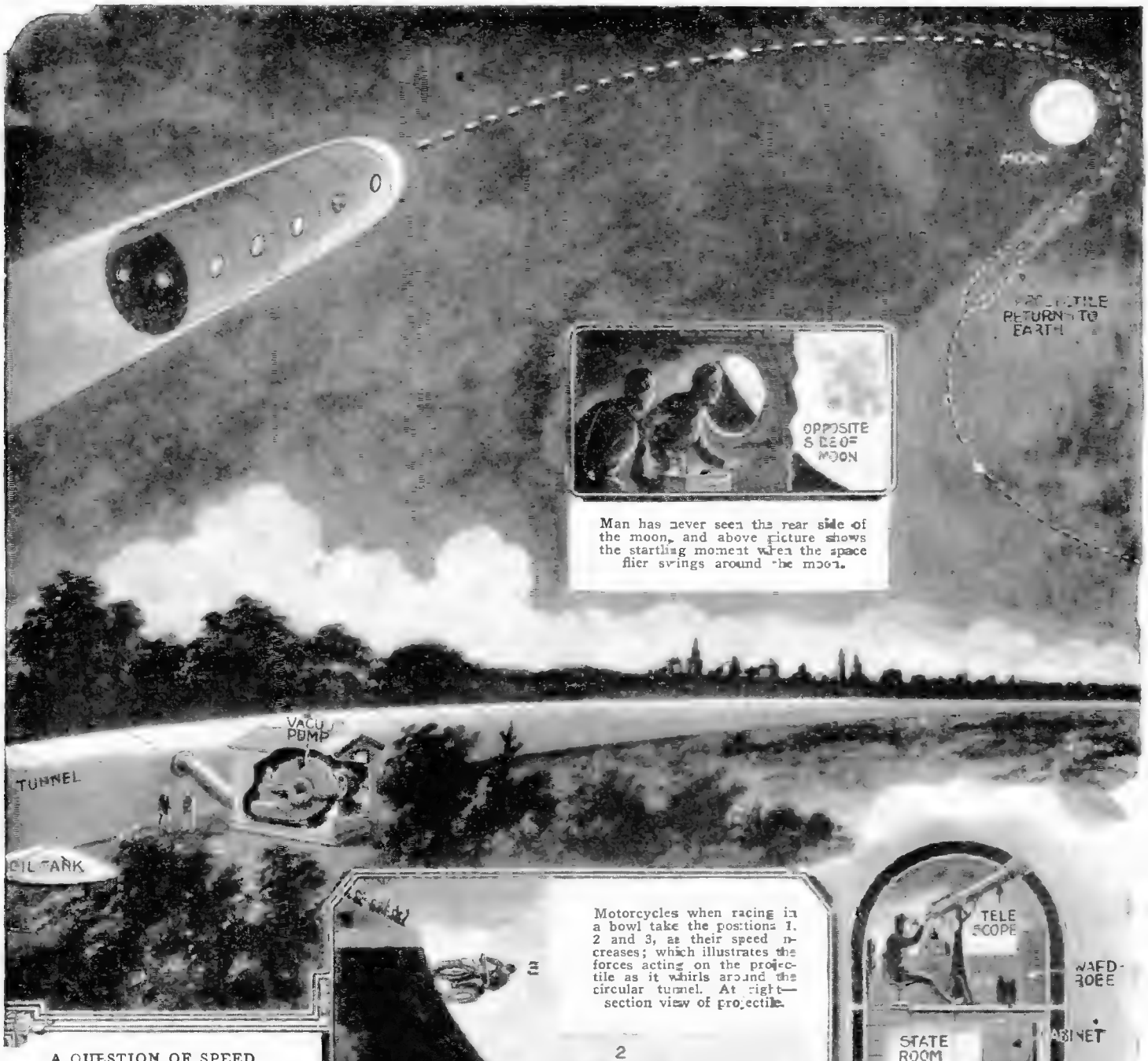
IF there is an idea which always has excited the adventurous spirit of numerous investigators it is certainly that of the exploration of the worlds gravitating along with our earth around the sun, and in the first place, the investigation of the moon, the satellite of our planet. This is the body nearest to us in space, its mean distance being only 243,000 miles, which a cannon ball going at the rate of 500 yards a second would reach in about eight days.

The proof of this preoccupation is given by the considerable number of stories written on this subject from Lucien de Samosate down to Miral and Viger, not forgetting Goodwin, Cyrano de Bergerac, Edgar Allen Poe, Jules Verne and H. G. Wells. But it is to be noted that none of these writers in their imaginary voyages have used the means, we will not say possible ones, but one which is even plausible, of effecting the crossing of the intervening space. None of the ways suggested could ever be carried out. One proposes balloons, others the propulsive force of powder in an enormous cannon the eruption of a volcano finally the employment of a material opaque to gravitation, which of course is not in existence, and radium rockets which also do not exist.

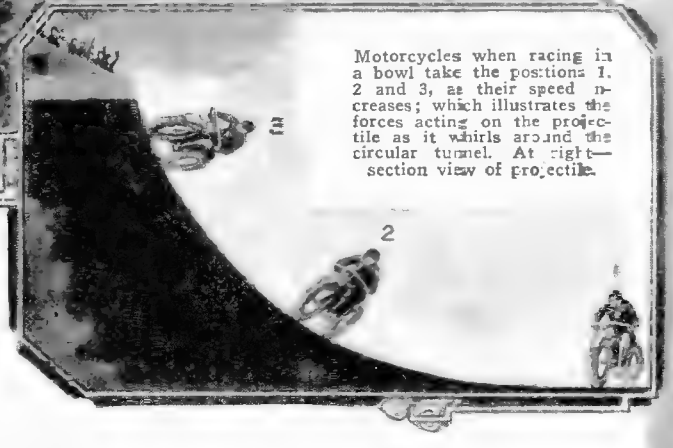


Sectional view of tunnel at left shows how rails are arranged so as to take the strain of the whirling projectile as it spins around the circular tunnel.

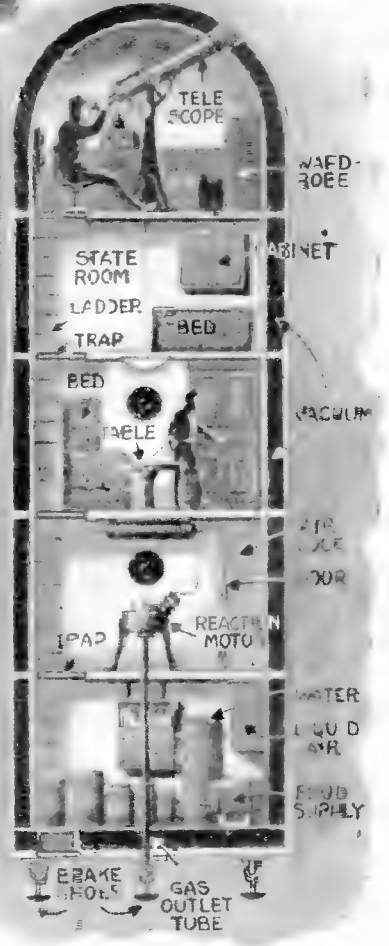
Large picture above shows part of circular tunnel with skin broken away to show projectile. When projectile leaves runway, the under carriage is dropped. The smaller view at the right shows projectile on its way to the moon after being hurled from the circular tunnel and runway. The passenger-carrying car spins around the tunnel until it reaches a sufficient velocity to overcome the gravity of the earth.



Man has never seen the rear side of the moon, and above picture shows the startling moment when the space flier swings around the moon.



Motorcycles when racing in a bowl take the positions 1, 2 and 3, as their speed increases; which illustrates the forces acting on the projectile as it whirls around the circular tunnel. At right—section view of projectile.



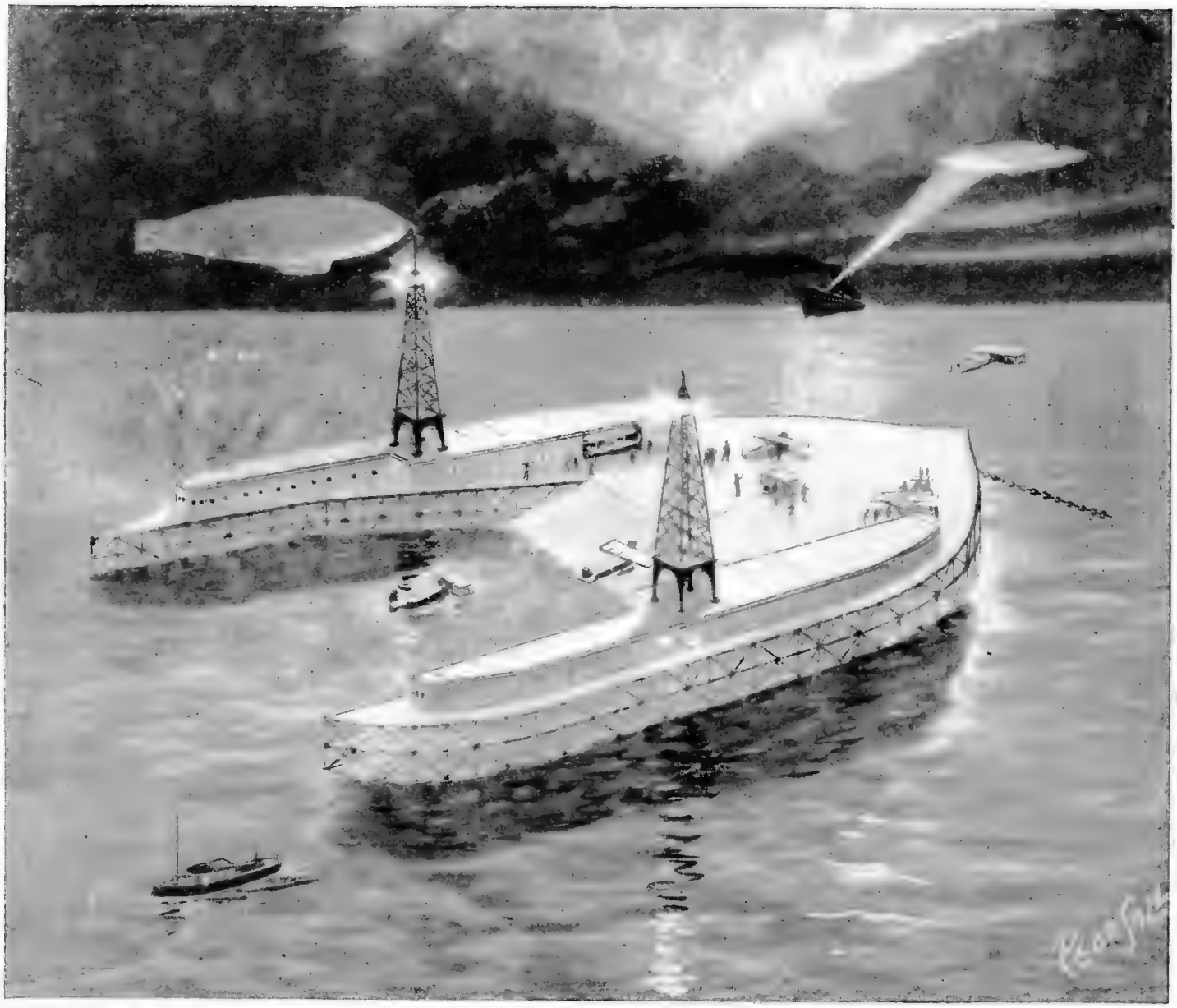
A QUESTION OF SPEED

BUT because a practical or reasonable idea has not yet been emitted by our romancers, does it follow that the problem is insoluble and above the possibilities of modern science? Students of the subject, scientists of high reputation hold different ideas. Today, now that our planet is entirely conquered, that, so to say, there is nothing from the equator to the pole in the way of a single point of its surface unexplored, when we possess efficient processes of locomotion through the element so long rebellious, the ocean of air, man wishes to continue to extend his domination. Our globe seems too small for his ambition. He wishes to increase his domain, taking in the neighboring worlds, especially this near province the moon, the half of which only is known from the long range view through the telescope, and which ought to hold within its mass, rich mineral treasures which can be exploited. Is it then foolish to try to reach it?

To rise towards the heavens, to pass out of the immediate zone of the attraction of the earth, and to look for other worlds across the gulf of space, this dream is still in force, as the calculations of eminent astronomers have proved that the desired speed can be imparted to a moving body leaving the surface of the earth. It is sufficient that a body be projected from our globe with a velocity of about 15,000 yards as it leaves the atmosphere, to be able to reach the zone of attraction of another world wherever it may be. The moving body will never fall back upon the earth. But to reach the moon, this limited speed is not necessary. To reach its sphere of attraction, situated at some 78,000 leagues from the surface of our planet, the initial velocity should be about 13,000 yards per second.

Is the attaining of such a velocity, above the possibility of realization by actual mechanical means? We are not the only ones to believe it is possible; as long ago as 1913 two French engineers described the process capable of giving us this propulsion. Very properly these engineers MM. Mas and Drouet divide the problem into two parts

(*Continued on page* 462)



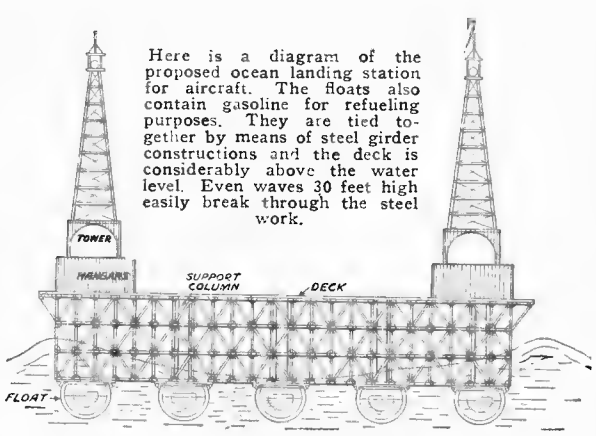
Above is a pictorial view of a landing station for use along the great circle route to Europe from New York. This type of a vessel is floated by immense double pontoons, the inner compartments of which contain the gasoline, while the outer is the buoyant body. Note the artificially constructed basin protected from the winds by the vessel itself. Hangars for planes, quarters for crew and airmen and mooring towers for dirigibles are found. The ocean island has its own meteorological department and its own radio station. Both are a distinct aid to aviators.

Ocean Islands for Aircraft

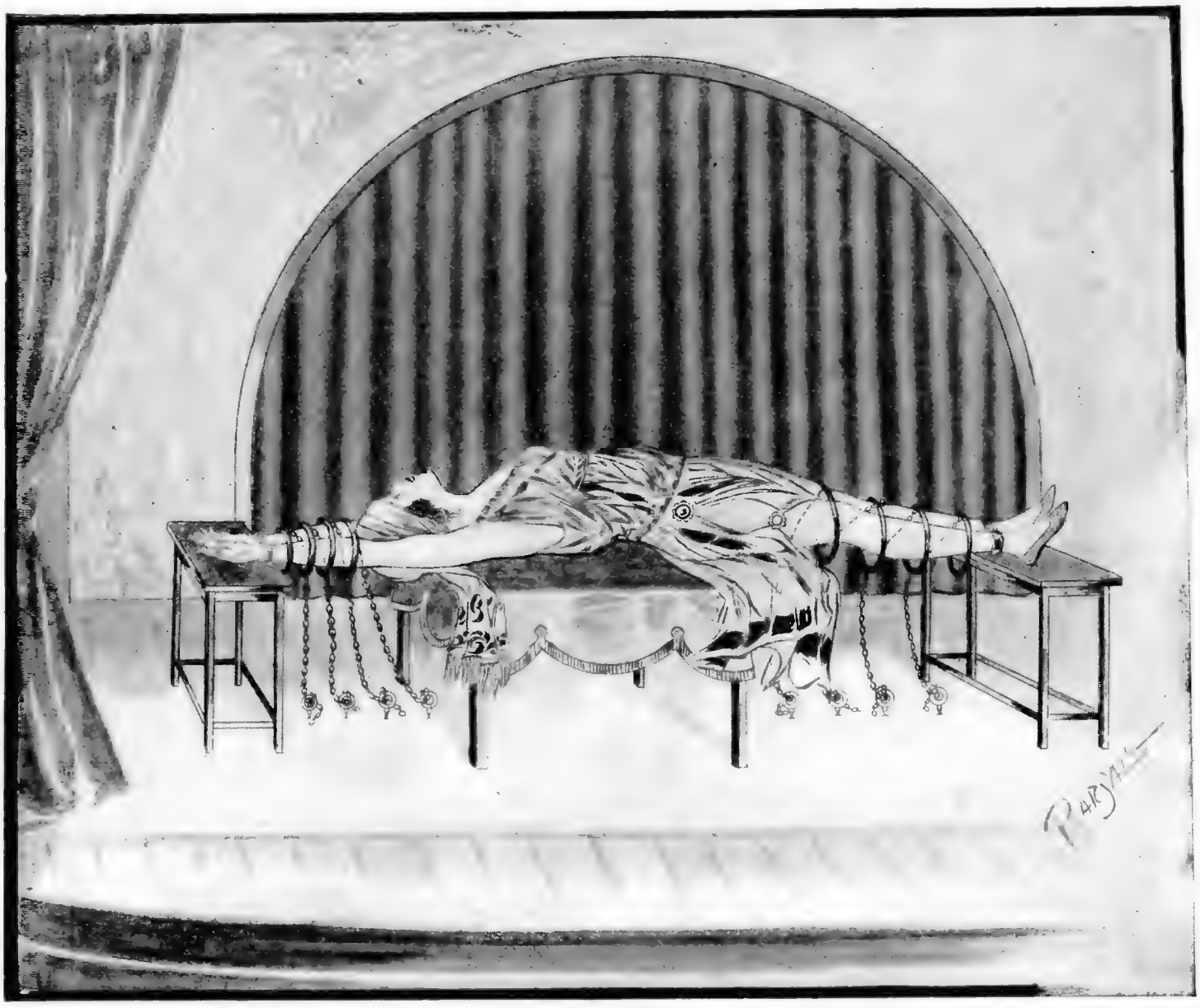
Transoceanic Aircraft Flights Will Be Greatly Stimulated by the Building of Three or Four of These Refueling Depots

By E. ZELONI

THE epochal flights of Lindbergh, Chamberlin and Byrd have demonstrated the ability of aircraft to span the waters separating the old and new continents. While these flights were certainly remarkable as far as stimulating the future of aviation and also demonstrating the worthiness of aircraft for intercontinental travel, the airplane is not yet developed to such an extent that daily trips could be taken, nor can modern planes carry a large amount of cargo and sufficient fuel to insure safety. Col. Lindbergh, along with many others, has advocated the use of landing stations anchored in mid-ocean so that transoceanic fliers would always have a haven of safety in severe storms or in the case of engine trouble. Along with other ideas for such ocean islands, we find one patented by Giuseppe Pino. This plan is indicated in our illustration. It consists of a large vessel probably a thousand feet long, built so as to withstand the terrific pounding of the most violent waves. Not only should the structure hold up under this incessant barrage, but it must be so constructed that the deck will not rise and fall with the waves, enabling the aviator to be sure of his landing field and not level out for landing as the field drops away 30 feet beneath him. The structure mounted on large floats is quite capable of doing this and even severe storms produce no undulating motion of the island the inventor claims.



Here is a diagram of the proposed ocean landing station for aircraft. The floats also contain gasoline for refueling purposes. They are tied together by means of steel girder constructions and the deck is considerably above the water level. Even waves 30 feet high easily break through the steel work.

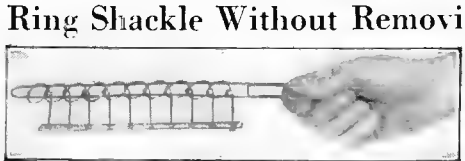


Above is an artist's conception of the way in which a fair damsel would be trussed up in the escape device described in the accompanying text. It will be observed that both hands and feet are securely shackled; same sized rings are then placed around the arms and legs and chained to the floor.

Marvelous Escape Trick

Escaping from a Ring Shackle Without Removing the Handcuffs

THE illustration at the top of this page shows a recently patented escape trick in which a person on the stage is shackled hand and foot after a number of rings had been positioned about the extremities and tied together by chains. The shackles are sealed so that they cannot possibly be opened and according to Theodore P. Brunner, of Los Angeles, Calif., the inventor of the trick, protected by patent No. 1,625,452, the arrangement is such, that from all appearances, it seems impossible for the exhibitor to free himself. Really this escape trick is a puzzle and the puzzle is based upon the old ten-ring trick indicated in the photograph on this page. By peculiar manipulations well known to anyone who has solved this ring trick, all ten rings can be removed from the closed oval rod. The rings themselves, as the photograph illustrates and as the diagrams show, are of the same size. They cannot be slipped through each other. The operation is as follows: First the two end rings are slipped over the arms and then down through the opening between them. This now permits the exhibiter to free the fourth ring, pass it over his hands and drop this through the opening between the arms. The next move is to put the first two rings back in the position they first occupied. Then release the first ring and free the third. Bring back the first ring and then drop the first and second through the arms. The same procedure is followed with the feet. Anyone not knowing the operation would find it difficult to get out of a shackle of this nature. It is a very ingenious trick.



This trick is based upon the puzzle shown in the photograph above.

FIG. 1

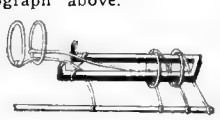


FIG. 2

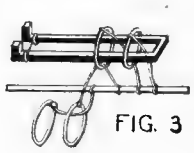


FIG. 3

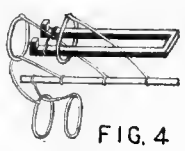


FIG. 4

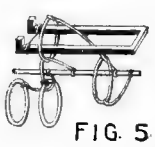


FIG. 5

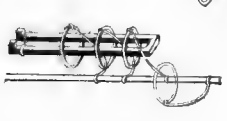


FIG. 6

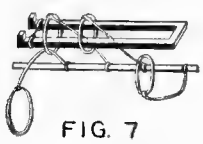


FIG. 7

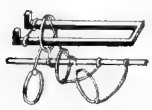


FIG. 8

FIG. 9

FIG. 10

Fig. 1 gives us a schematic diagram of the way in which an artist is manacled and chained prior to effecting his escape. Fig. 2 gives us the next move and the remaining figures indicate the sequence of the manipulations. The cuffs are not removed.

Gravity Nullified

Quartz Crystals Charged by High Frequency Currents Lose Their Weight

ALTHOUGH some remarkable achievements have been made with short-wave low power transmitters, radio experts and amateurs have recently decided that short-wave transmission had reached its ultimate and that no vital improvement would be made in this line. A short time ago, however, two young European experimenters working with ultra short-waves, have made a discovery that promises to be of primary importance to the scientific world.

The discovery was made about six weeks ago in a newly established central laboratory of the Nessartsaddin-Werke in Darredein, Poland, by Dr. Kowsky and Engineer Frost. While experimenting with the constants of very short waves, carried on by means of quartz resonators, a piece of quartz which was used, suddenly showed a clearly altered appearance. It was easily seen that in the center of the crystal, especially when a constant temperature not exceeding ten degrees C. (50 degrees Fahrenheit) was maintained, milky cloudiness appeared which gradually developed to complete opacity. The experiments of Dr. Meissner, of the Telefunken Co., along similar lines, according to which quartz crystals, subjected to high frequency currents clearly showed air currents which led to the construction of a little motor based on this principle. A week of eager experimenting finally led Dr. Kowsky and Engineer Frost to the explanation of the phenomenon, and further experiments showed the unexpected possibilities for technical uses of the discovery.

Fig. 1. The gravitation nullifier is shown in this illustration. The quartz crystal may be seen supporting a 55-pound weight. Dr. Kowsky is shown in a top coat because of the temperature at which the experiments were performed.

Some statements must precede the explanation. It is known at least in part, that quartz and some other crystals of similar atomic nature, have the property when exposed to potential excitation in a definite direction, of stretching and contracting; and if one uses rapidly changing potentials, the crystals will change the electric waves into mechanical oscillations. This *piezo electric* effect, shown in Rochelle salt crystals by which they may be made into sound-producing devices such as loud speakers, or reversely into microphones, also shows the results in this direction. This effect was clearly explained in August, 1925 *Radio News* and December, 1919 *Electrical Experimenter*. These oscillations are extremely small, but have nevertheless their technical use in a quartz crystal wave-meter and in maintaining a constant wavelength in radio transmitters. By a special arrangement of the excitation of the crystal in various directions, it may be made to stretch or increase in length and will not return to its original size. It seems as if a dispersal of electrons from a molecule resulted, which, as it is irreversible, changes the entire structure of the crystal, so that it cannot be restored to its former condition.

The stretching out, as we may term this strange property of the crystal, explains the impairment of its transparency. At the same time a change takes place in its specific gravity. Testing it on the balance showed that after connecting the crystal to the high tension current, the arm of the balance on which the crystal with the electrical connections rests, rose into the air. The illustration, Fig. 3, shows this experiment.

This pointed the way for further investigation and the determination of how far the reduction of the specific gravity could be carried out. By the use of greater power, finally to the extent of several kilowatts and longer exposure to the action, it was found eventually that from a little crystal, 5 by 2 by 1.5 millimeters, a non-transparent white body measuring about ten centimeters on the side resulted, or increased about 20 times in length on any side (see Fig. 4.) The transformed crystal was so light that it carried the whole apparatus with itself upwards, along with the weight of twenty-five kilograms (55 lbs.) suspended from it and floating free in the air. On exact measurement and calculation, which on account of the excellent apparatus in the Darredein laboratory could be readily carried out, it was found that the specific gravity was reduced to a greater amount than the change in volume would indicate. Its weight had become practically negative.

There can be no doubt that a beginning has been made toward overcoming gravitation. It is to be noted, however, that the law of conservation of energy is absolutely unchanged. The energy employed in treating the crystal, appears as the counter effect of gravitation. Thus the riddle of gravitation is not fully solved as yet, and the progress of experiments will be followed further. It is, however, the first time that experimentation with gravitation, which hitherto has been beyond the pale of all such research, has become possible, and it seems as if there were a way discovered at last to explain the inter-relations of gravity with electric and magnetic forces, which connection, long sought for, has never been demonstrated. This report appears in a reliable German journal, "Radio Umschau."

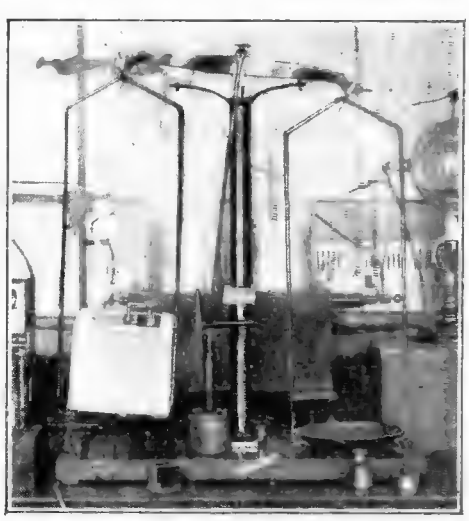


Fig. 3. This shows how the quartz crystal lost weight when subjected to the high frequency current. The original crystal was balanced on the scale.

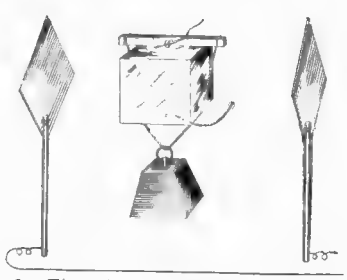


Fig. 2. The schematic diagram of the experiment is shown in this illustration. The high frequency oscillator has been omitted for clearness.

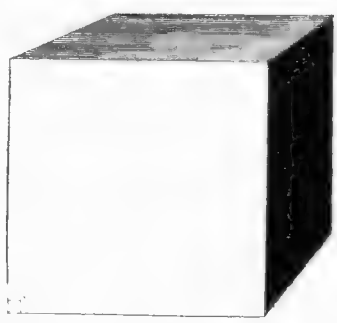


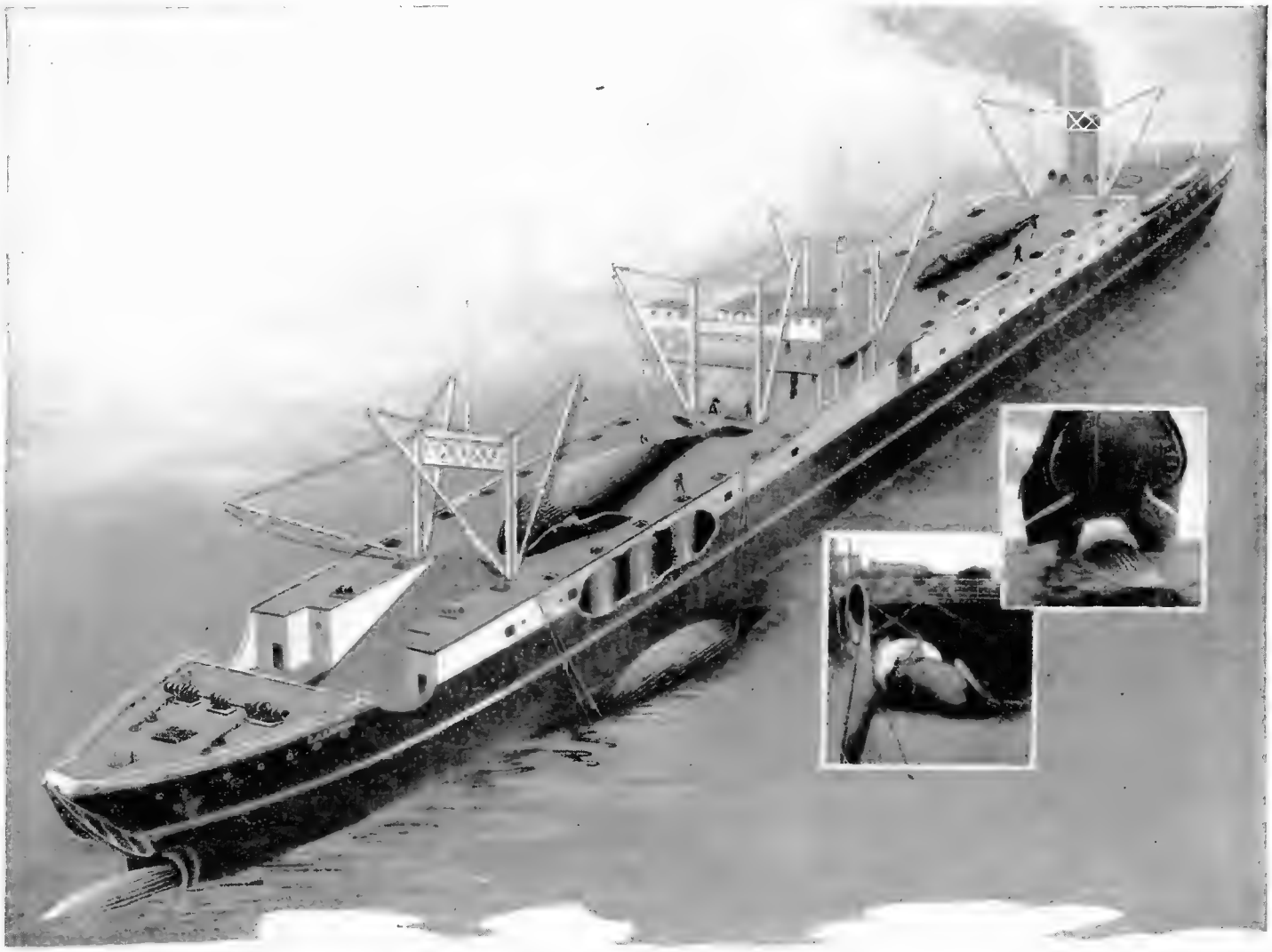
Fig. 4. This illustration shows the relative sizes of the crystal before and after the experiment. It is approximately twenty times its original length on any side.

Don't fail to see our next issue regarding this marvelous invention.

A Ship that Swallows Whales

Latest Whaling Vessel Has Apparatus for Obtaining Every Bit of Oil

By C. McKNIGHT SMITH



The whaling ship "C. A. Larsen" of Sandefjord, Norway, represents the very latest scientific development in a complete floating whaling depot and factory combined. This huge ship of some 17,000 tons dead weight "swallows" the dead bodies of whales which are brought in by the smaller "killer" boats.

The two inset photos show front view of the ship's mouth opened and carcass of whale about to be drawn up runway; also a view of the runway taken from the deck, with body of a whale being drawn up to the deck. Steam boilers are carried for the purpose of removing the oil from the blubber

SCIENCE and invention, simple words in themselves, yet fully descriptive of the whaling depot and floating factory combined in the steamship "C. A. Larsen" of Sandefjord, Norway, formerly the oil tanker "San Gregorio" of 17,200 dead weight tons.

In 1923, C. A. Larsen, a Norwegian made the first of these efficient whaling expeditions in the steamer "Sir James Clark Ross" and took his commercial ships farther south than any other commercial vessels had gone. The 1924 voyage was marked by Mr. Larsen's death but financially this voyage and the one in 1925 were so successful that under the leadership of Mr. Magnus Konow who succeeded Mr. Larsen as president of the whaling company, the oil tanker "San Gregorio" was bought and reconstructed into the "C. A. Larsen" the pivot of our story.

Requirements of the whaling industry for which the ship was modernized resulted in a transformation that left but little of the vessels's former appearance.

The sides of the ship, and midship superstructure were raised and open decks fore and aft of this superstructure were built to facilitate the work of modern whaling for which the vessel was to be used.

From the forward end of the forward deck an iron-sheathed inclined slideway about twenty feet wide was built, the lower and outboard end terminating in a tunnel mouth; capped with a hinged hatch or lid, as shown in our illustrations; the first of its kind to be installed in any vessel for the purpose it was invented.

The hatch or lid has an arm or lever bar which swings on a shaft near the extreme bow of the ship and by hauling on the heavy wire cables which are attached to the end the lid itself is raised and the tunnel opening exposed.

The entire outboard end of this novel feature is so shaped that the cap or lid proper when closed is all but watertight and is so reenforced as to be almost solid. Shaped somewhat like the share of a plow the whole structure offers but little resistance in the speed of the ship and acts as a buffer or ice breaker when driving through the ice fields.

HOW WHALES ARE "SWALLOWED"

It is through this tunnel that the carcasses of the dead whales are hauled to the open stripping deck above, where the blubber is stripped off and cut into pieces, which are dropped through hatchways in the deck directly over the rows of steam boilers on the deck below. As fast as these boilers are filled they are capped and the blubber oil is separated from the tissue by steam boiling.

After the blubber has been stripped, the carcass is hauled to the after deck where all the bone and cartilage is separated from the fleshy part, ground, and whatever oil there is in the bone meal is pressed out and the products thus obtained from these two operations are subjected to various separating and refining processes and placed in the storage tanks until the vessel reaches port where the cargo is transferred to tank cars for distribution and delivery to the consumers, the principal ones being the manufacturers of fine soaps.

These operations are carried on night and

(*Continued on page* 466)

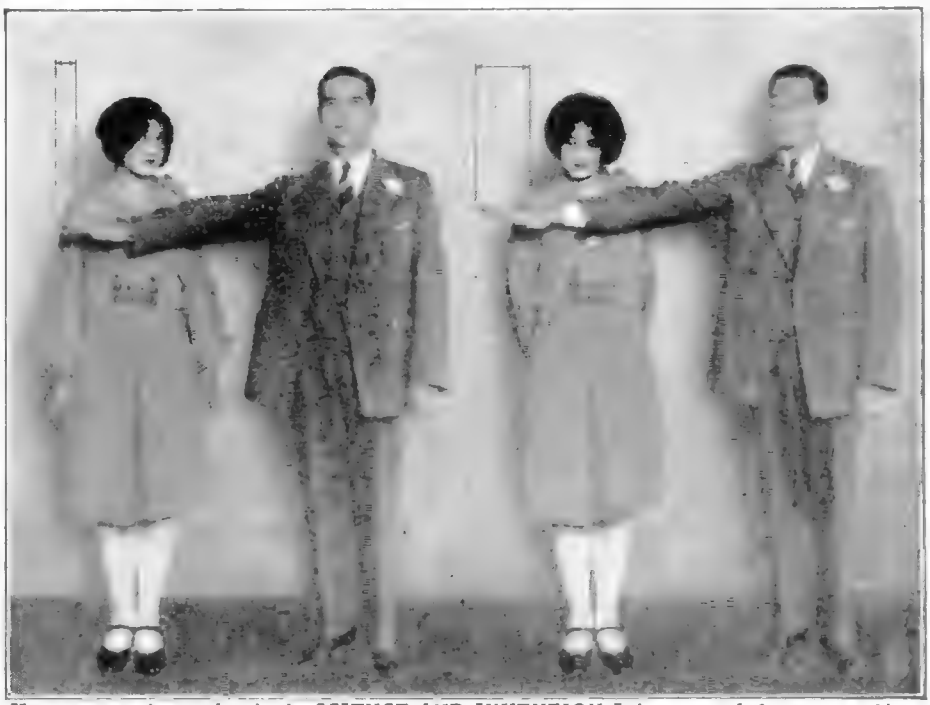
The Man Who

Remarkable Action Photographs of X-Ray Explanation of How

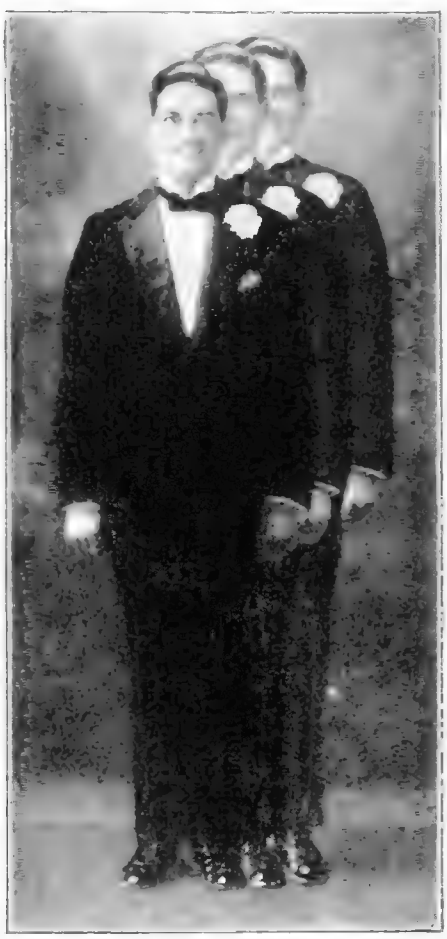
THE above photograph was taken at the New York X-ray Laboratories with Willard, "the man who grows," lying down on the table. The plate is under his head and neck and the X-ray tube above him. Reading from left to right, we have the X-ray specialist, Harry Kwittken. Alongside of him the doctor with the glasses is George P. Ratner, D.D.S., and the gray haired specialist is John H. Corisch, M.D., all of the Laboratories. Willard was X-rayed twice; once when in a normal position and the second time when his neck was extended. As can be seen from the photographs on the opposite page, there was quite a difference.

ON the accompanying pages we show a remarkable series of photographs of Willard, known in theatrical circles as "the man who grows." Mr. Willard has appeared before the crowned heads of Europe and has toured this country from end to end. Before proceeding with the scientific aspect of this particular marvel, it might be well to mention that Mr. Willard was born at Painesville, Ohio, on July 27, 1874, although he seems to be considerably younger than he actually is. He joined the Barnum and Bailey Circus in 1882.

On actual Bertillion measurements, Mr. Willard was able to stretch his body so that it was 7½ inches taller than when in his apparently relaxed position. He can stretch his arms so that they will measure 6¼ inches more from tip to tip when stretched than when contracted, and his neck



Here are two views, taken in the SCIENCE AND INVENTION Laboratory, of the arm-stretching experiment. The first at the left shows an apparently normal position. Observe the difference between the finger-tip of Mr. Willard's hand and the shoulder of Miss Belle Fox, who is posing in the photograph with him. Then compare with the photograph at the right and notice the difference. Both participants occupied the same relative positions.



HERE is a composite photograph of Willard in the various stages of his growth. All three pictures were taken on the same plate. Notice that the toes practically touch the same line drawn horizontally across. Not only does Mr. Willard's head rise up considerably, but shoulders, arms, and even the trouser legs move upward as he apparently grows while you wait. Bertillon measurements maintain that a change in height of 7½ inches from the relaxed to the extended position was accomplished. The difference in reach from relaxed to extended position is 6¼ inches, whereas the measurement from the spine to the finger-tips is 6 inches greater when he stretches his arm out.

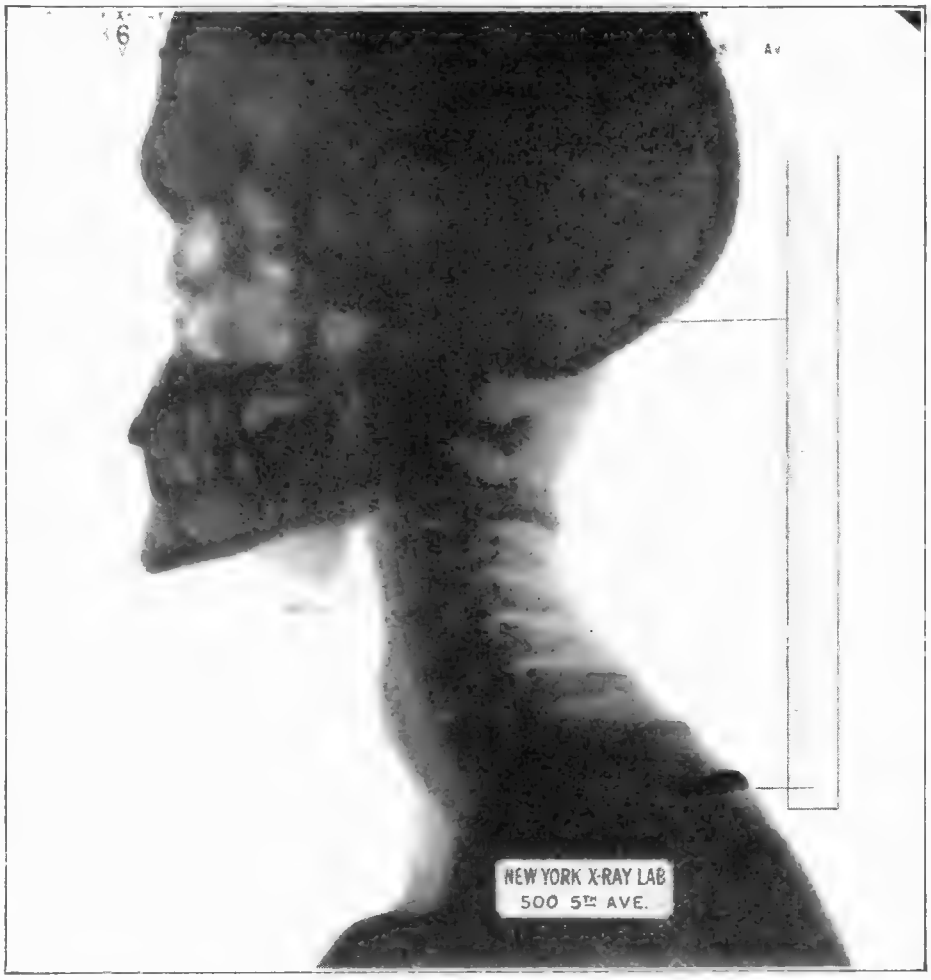
Here is a view of "the man who grows" when in the growing position. Compare the relative heights and then compare the difference in stature in the photograph at the right. This is Mr. Willard's normal position. Now cast your eyes on the X-ray photographs on the accompanying page and see exactly how this stunt is accomplished.

Grows

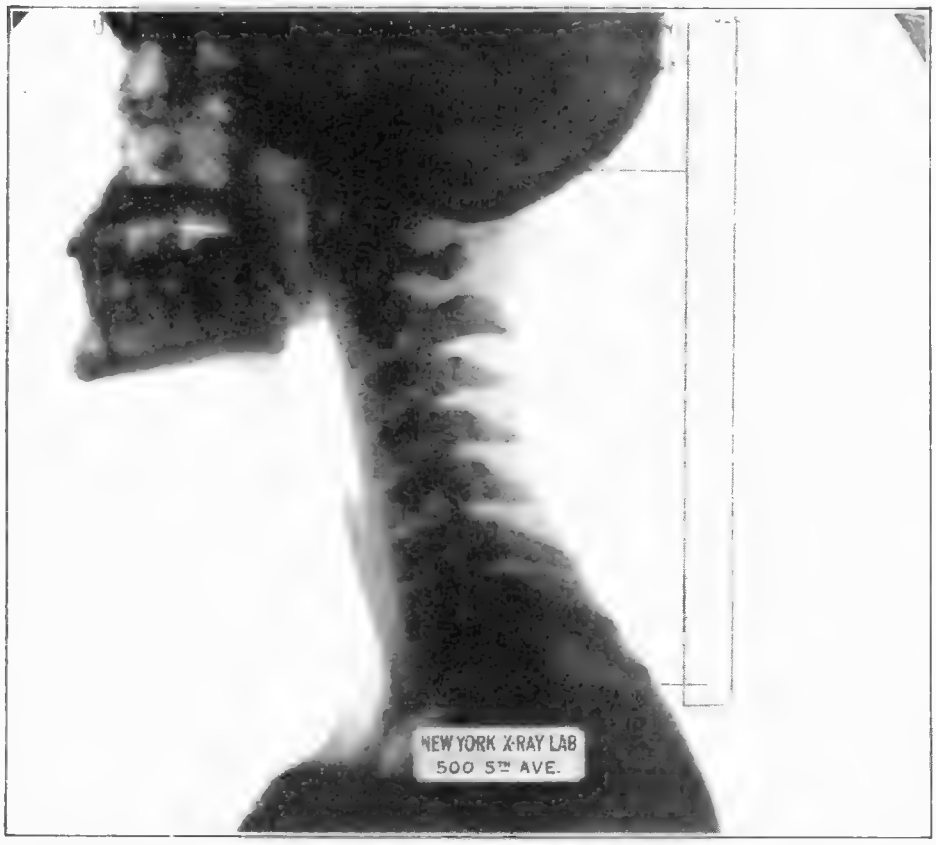
Willard and an He Does It

can stretch 2 inches; whereas the difference in measurement between the spine and the finger-tips is 6 inches longer when extended than when contracted. The photographs on this page graphically show this. In one view the arm is held out at the side, just barely passing beyond the shoulder of Miss Belle Fox, posing in the pictures with him. In an adjoining scene and with the characters in the same position, the arm is extended. Observe here how far it stretches beyond the young lady's shoulder. Then take a look at the two photographs indicating a change in height. In one of them Mr. Willard's height is but slightly greater than that of Miss Fox. An accompanying view shows the difference in height when "the man who grows," extends himself. A third illustration shows three changes in height, all taken from the same focus and with Willard's feet along the same chalk line. Note the successive increases in stature. In order to ascertain how he accomplished this effect, the editors went up to the New York X-ray Laboratories at 500 Fifth Ave., where they placed Mr. Willard on the table. A lead marker was then fastened with adhesive tape to the head. The skull being composed of many bones which are joined together so tightly that they cannot move, established the marker's permanent location. The length of the neck was then measured from this marker down to the seventh cervical vertebra.

Actual X-ray examination reveals that there is no separation in the inter-costal cartilages and that the bones are separated just as widely when the neck is stretched as when contracted. At least that is the inference one will draw when accurately measuring the distance by means of a pair of dividers. It therefore follows, that, if there is a slight variation, the total would not be great enough to appreciably affect the length of the neck or the height of the exhibiter.



Here is an X-ray photograph of Mr. Willard's head and neck. The small black rectangle on the skull to which the line from the ruler leads, is a strip of lead attached to the skull by means of adhesive tape. This marker cannot shift unless the head shifts. The zero mark of the scale is taken at the seventh cervical vertebra. The ruler indicates that the distance between the two points in an approximately normal position was 6 15/24ths inches. Now view the photograph diagonally below.



In this view we find the same lead marker on the skull. We also find the point of the seventh cervical vertebra as being the zero mark of the scale. Both photographs being taken with the X-ray tube at the same distance from the subject, it becomes a simple matter to measure the difference in the length of the neck. The scale here shows a reading of 7 17/24ths inches or a difference of 1 1/12 inches in the two views.

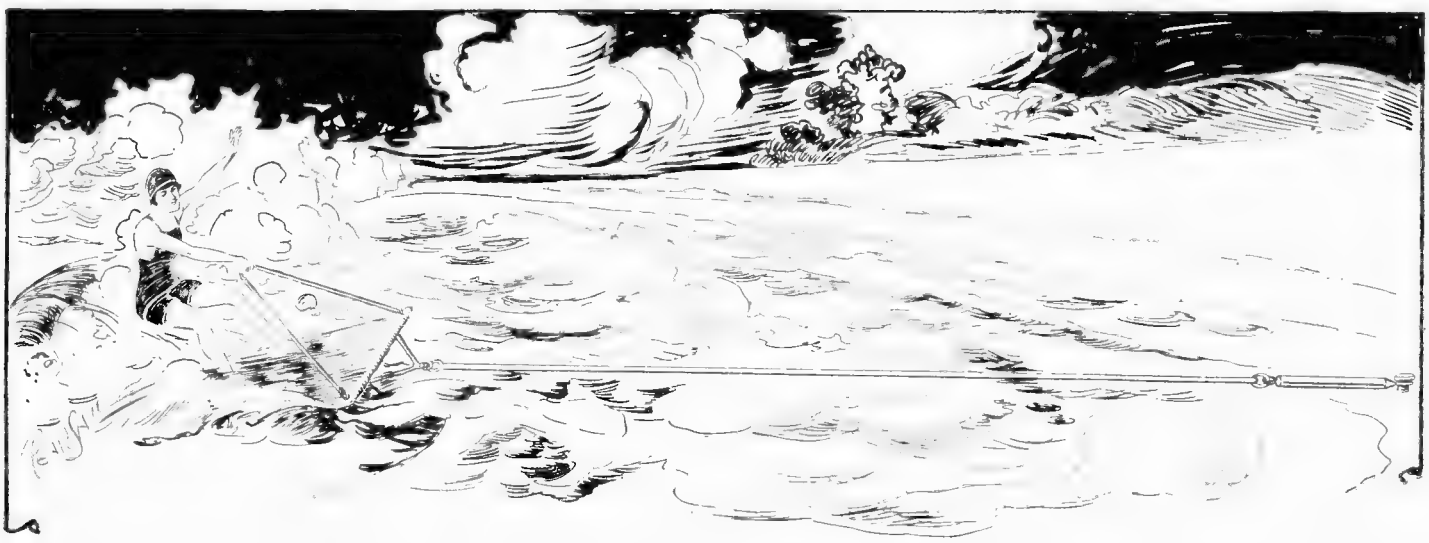
What then is the secret of Mr. Willard's success? The answer is quite apparent by viewing the X-ray photographs on this page. It will be observed that the spine has a peculiar curvature which in Mr. Willard's case is perhaps greater than that of the average man. By purely muscular exertion he is able to cause the vertebrae to assume a nearly perfectly straight line. In this way he can extend the length of his neck, according to some measurements, for a distance of 2 inches, but in these X-ray photographs to the length of 1 1/12 inches. In the act of stretching his hands out sideways and increasing the tip to tip measurement, most of the stretching is done at the shoulder. The shoulder is capable of quite a movement, laterally from the center of the spine. By training, Mr. Willard has been able to increase this movement so markedly that his demonstration is daily surprising thousands.

And so we might pass this information along to those who are short of stature. Walk straight. The spine has a graceful compound curve which is its normal condition. This curve increases materially when people slump in their chairs and make no attempt to straighten up even while walking. Those who would like to be taller might increase their height by walking erect, and by considerable practice they might be able to duplicate Mr. Willard's 7½ inch change from the normal to the tall position.

More Summer

Being a Series of the Latest Pleasure

By JOSEPH H.



The above artist's illustration indicates a surf board which anyone can ride. Walking out into the surf and stretching the spring located at the shore, the bather is able to impart the initial momentum to the surf board to insure his successful riding of the waves. A thrilling sport indeed.

ON these rather warm days our thoughts naturally turn to the seashore and the summer resorts. Most of us have seen the time-worn amusement devices and even though we still get a thrill out of them, there are many others which have not to this day received the test of their operation. Then, on the other hand, we find quite a few devices which have been employed to such a limited extent that knowledge of them is by no means universal.

There is the invention of Mr. Thomas E. Carroll of Washington, D.C., who has developed a device for riding the surf.

The principal object of this invention resides in the provision of a spring or elastic band in a suitable housing which is affixed at one end to a spike driven into the sands of the beach. The other end connects directly with the surfboard. When the bather takes his board out into the waters, it is frequently difficult for him to time his forward thrust in such a way that subsequent waves will carry him in to the beach. The waves passing at a considerable speed, generally pass the swimmer or break over the board and swimmer. With the spring under tension, the bather can catch the first wave and ride to shore on it. The spring is encased in a metallic or rubberoid covering to prevent injury to those on the shore.

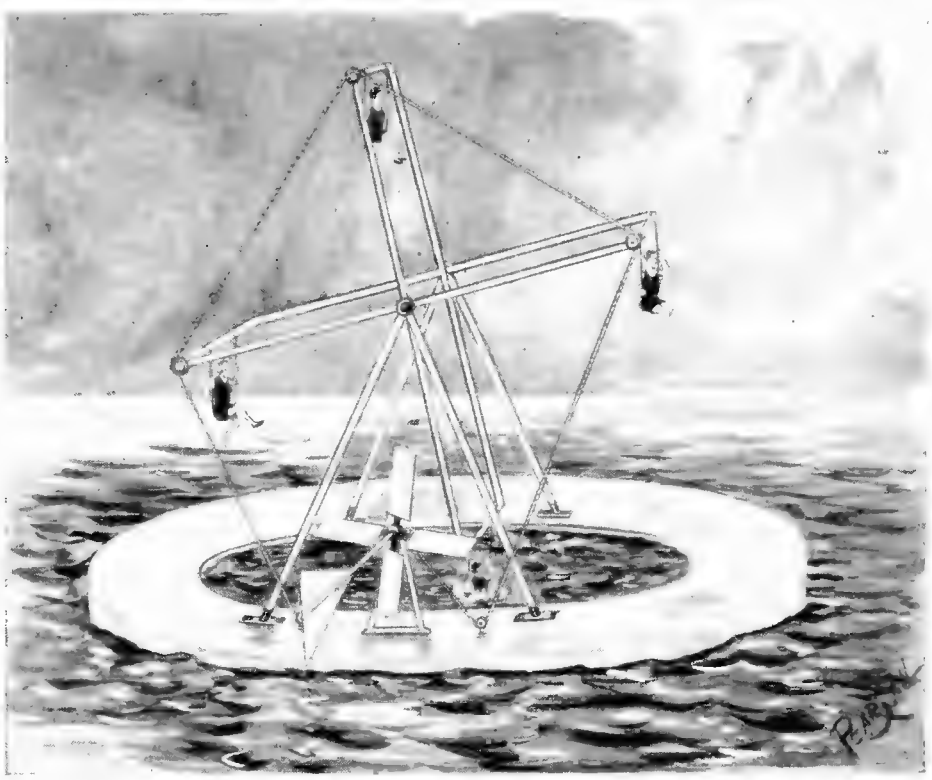
A system devised by the writer is also shown on this page. This consists of a large raft which may be of oval or rectangular construction, the center of which is open. On the raft there are four uprights set in the form of trusses and made of pipe fittings. These hold an improvised Ferris wheel, also made of pipe. From each of the cross-arms of the wheel a seat depends suspended by two ropes. The ropes turn freely about the cross pieces. While the mechanism could undoubtedly be propelled by paddling the feet through the water when reaching the lower portion of the rotation, it is suggested that a wind-mill be employed to effect this rotation. As the illustration indicates, a rope passes over pulleys on the ends of cross arms and over a pulley on the wind-mill. A small vane extends from the propelling device so as to keep the mill nosed into the wind. The float is anchored from a point opposite the wind-mill. This also facilitates keeping the article headed into the wind. On extraordinarily calm days, a fifth swimmer can rotate the entire wheel by pulling on the ropes or turning the mill.

Then there is the monorail amusement device invented by Halligan Johnson of Venice, Calif. The cars in this monorailway are free to move laterally as well as vertically. The construction is made to imitate a large serpent, worming back and forth and up and down on the single rail. A gasoline engine drives the mechanism by coupling directly to the two drive wheels through gears, as the detailed diagram shows. The cars can-

PHONEY PATENTS

Our old friends will remember the useless and brainless, but side-splitting inventions that appeared in the old ELECTRICAL EXPERIMENTER Magazine in the Phoney Patents Department. They are with us again, uproariously funny, and cleverer than ever, in the new FRENCH HUMOR Magazine, now on sale at all newsstands for 10c per copy.

$3.00 a week is paid for the best Phoney Patent. Get in on this now. If you haven't got acquainted with this new breezy laugh-tickler, be sure to reserve your copies at once. Buy a sample copy today.



Here is an automatic Ferris wheel which the average playground enthusiast can build of pipe fittings. The entire float is mounted by a chain at the end opposite the windmill. In this way the wind constantly acting on the vanes causes the Ferris wheel to turn and dips the bathers in the water at each revolution

Amusements

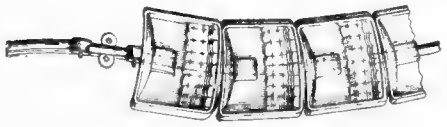
Devices Only Recently Patented or Just Put Into Use

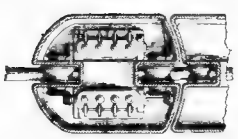
KRAUS

A new type of monorail for summer resorts is the scheme proposed by one inventor. This consists of a dragon with a serpentine body, the patrons sitting in each sector of the body. The mechanism is gasoline engine driven and the track itself, of cheap construction due to its being but one rail, winds up and down over the hills and into the valleys of the scenic arrangement provided by the artist.

not tip over the railway because the same rail serves as a guide for laterally operating wheels.

From Germany through Dr. Alfred Gradenwitz, comes the news and photographs of a bathing suit invented by A. Nix of Berlin. This suit has eight rubber cells sewed into it. Even after two of the air cells are emptied, the suit has sufficient buoyancy to carry the swimmer. In an upright position the swimmer can keep both his head and shoulders above the surface of the water.

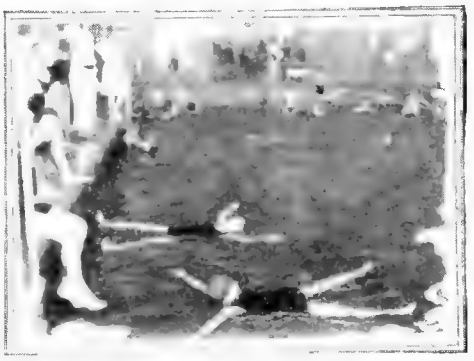




Here is a diagram of the monorailway shown at the top of this page. Inasmuch as the bed is a single track, it becomes necessary to mount the cars in such a way that they will not fall off the track. Frequently gyroscopes are resorted to to accomplish this. In this system, side rollers are employed.

Those unable to swim, will find such a suit of inestimable value because it does not interfere with the wearer's movements, nor does it present any outward sign of abnormality.

A World War cripple, Henry Uberto of Astoria, L. I., who was wounded in the shoulder during the war in such a manner as to prohibit swimming perfected the aquabike, as he calls the device, so as to enable him to enjoy many an afternoon in the water and get about even better than when he had the use of his arms. The aquabike is kept afloat by three small floats and an improvised bicycle transmission of the chainless type fitted

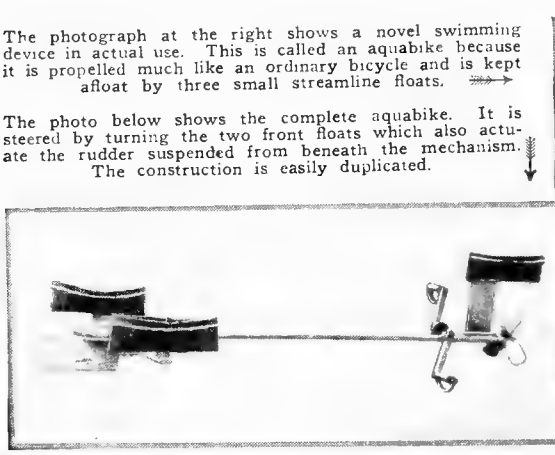


The photo above shows two swimmers in a German pool. They are using the new non-sinkable swimming suit.

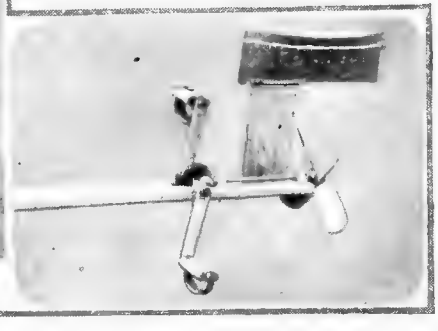
Photo at the left shows the non-sinkable swimming suits developed by a German inventor. Their appearance does not indicate that the suits contain air cells.

The photograph at the right shows a novel swimming device in actual use. This is called an aquabike because it is propelled much like an ordinary bicycle and is kept afloat by three small streamline floats.

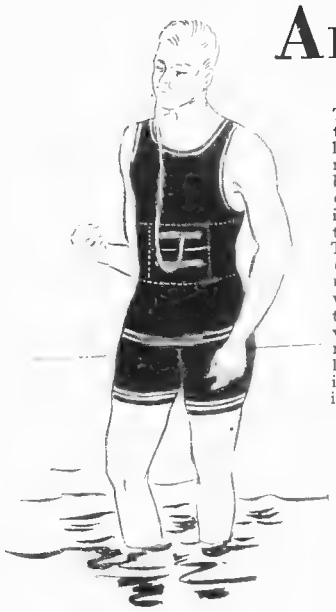
The photo below shows the complete aquabike. It is steered by turning the two front floats which also actuate the rudder suspended from beneath the mechanism. The construction is easily duplicated.



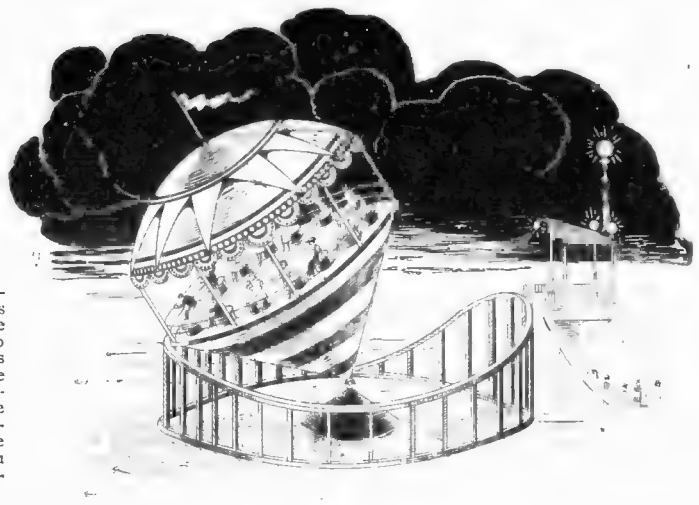
The photograph below shows the propelling mechanism of the aquabike. Essentially this is a four-bladed propeller, geared to a suitable crankshaft. It is operated the same as a bicycle, but the pedals are provided with stirrups to maintain the feet in the proper position.



More Summer Amusements



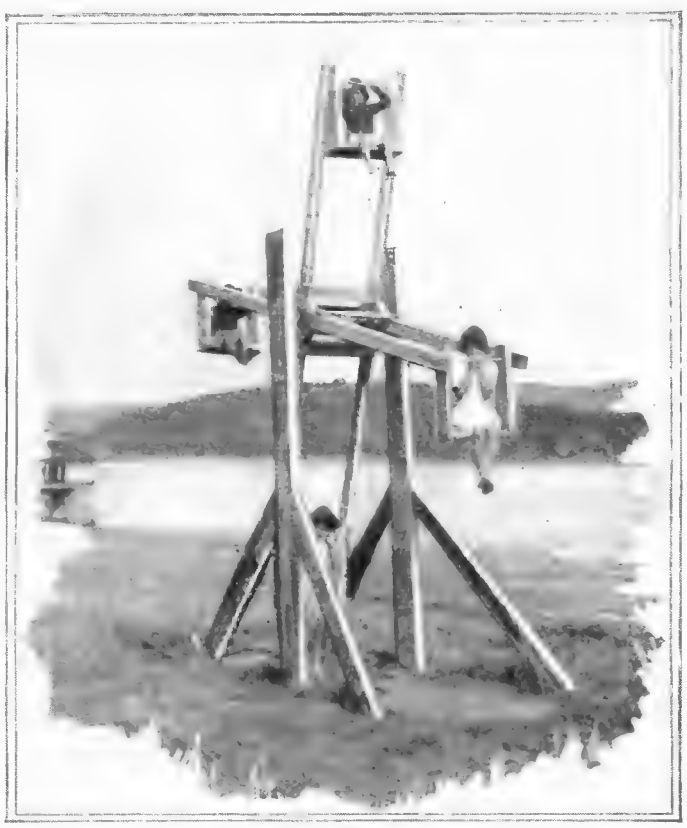
The illustration at the left shows a new type of bathing suit containing an inflatable sack. This sack can be blown up by the wearer or by turning a valve, gas may be released, causing it to flow into the compartment.



Here is a type of summer amusement which is guaranteed to produce that seasick feeling so much desired by patrons of amusement parks. The top is operated by a motor in the base and the track around which it gyrates is undulatory. The seats are provided with straps to prevent passengers from falling out.

with a propeller serves as the method of propulsion. Without going into the details of the device illustrated in the upper right-hand corner of page 404, we will note that we have here a round-about in the shape of a giant top. This amusement system was invented by Etienne Prost of Marseille, France. When in operation the article resembles a giant top revolving about its main axis and rolling with its marginal edge upon a track. It thus imitates the bearing of a spinning top which is about to stop revolving. No doubt this article will produce new sensations which, according to the inventor, are entirely different than those of other amusement devices. The claim is made that the mechanism is absolutely safe because the seats are rigidly connected to the platform and because of the rail which surrounds the turning top. The track upon which the round-about is adapted to roll has a depression in one side so that when the top comes to rest, its platform will be in a nearly horizontal position and on the level with the entrance station. A large universal joint at the base operated by a motor contained within the smaller cone and coupled to the shaft by a worm gear, causes this device to rotate.

A Buffalo inventor, Andrew Meilland, invented a bathing suit containing a compartment which can be inflated either by air pressure from a tank or by the lung power of the wearer, or by both if circumstances so demand it. A complex valve system enables the air cell to be instantaneously filled by a small tank of compressed air or carbon dioxide. This is done in cases of emergency, but for ordinary bathing purposes, the suit could be inflated by blowing through the rubber tube.



So that his children might enjoy the sunshine and air by other than ordinary means, an American father built this wheel of scrap lumber and a few pieces of pipe. It is propelled by the users who run along the ground to give it its momentum.

The next item of interest is the simplified Ferris wheel built of scrap lumber and pieces of pipe illustrated by a photograph. In this particular device the wheel is kept in motion by the children who are the passengers. The seats are made just low enough so that when a child sits upon them, the youngster is able to barely touch the ground on each revolution. A few quick steps impart sufficient momentum to the wheel to carry it along. Any father could build an article of this nature for his youngsters.

Games with baseballs have been the rage at many summer resorts. First there were those games employing a human target; then there is the trick of knocking the four cats from their racks with three baseballs. Subsequently, we saw *drop the dip* in which a subject sat on a platform directly coupled with a target and if the target was hit by a baseball, the subject would drop into a tank of water. In other places, striking the target with a baseball would release a trap and precipitate a small pig down an inclined chute. In all of these types of baseball target practices, whenever there was a victim, the victim stood very little chance to fight back. He either had to dodge the ball thrown at him or else receive it squarely. The device illustrated at the bottom of this page is one in which the victim can actually fight back; not with the same article of assault, it is true, but with perhaps a slightly better system. The baseball thrower in this device invented by Anton Hulsman of San Francisco, Calif., stands upon a platform. He receives three balls for the usual sum of 5c. The object of the game is to hit the victim who lies in a prone position on the legs. Just as the baseball thrower winds up, preparatory to the swing, at the victim, the latter's hand grips the lever. This spins the turntable and throws victim off.

"Hit the Jap on the legs and get a fine cigar!" is the slogan of the device at the left. In this device the victim has a means of defense other than dodging. Pulling on the lever he rotates the platform, precipitating the thrower.

Right: A type of boat which will undoubtedly become popular at the summer resorts this season. It is a board made as indicated, the user straddling a cloth seat. Sail or paddles propel the device.

Natural or Cultivated Pearl—Which?

Science Discovers New Way in which to Tell Difference between Natural and Cultivated Pearls

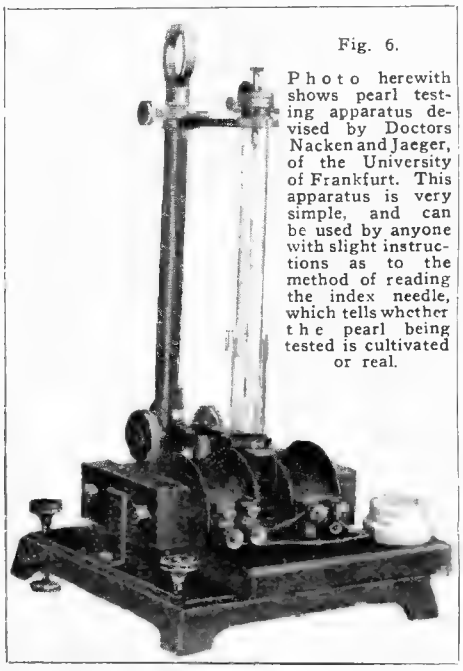


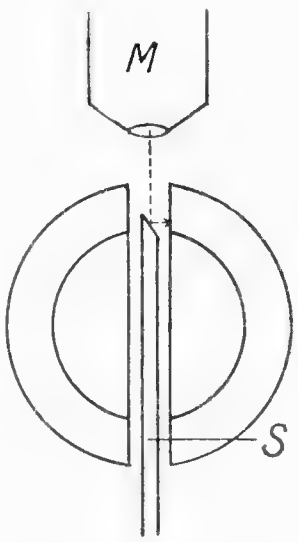
Fig. 6.

Photo herewith shows pearl testing apparatus devised by Doctors Nacken and Jaeger, of the University of Frankfurt. This apparatus is very simple, and can be used by anyone with slight instructions as to the method of reading the index needle, which tells whether the pearl being tested is cultivated or real.

THE pearl, greatly treasured from olden times, like the most valued jewels, is not free from counterfeiting. Between the commonest counterfeits and the most refined reproductions for which the Japanese hold the prize, there is a whole series of intermediate steps. In the course of time, a complete branch of industry has developed, especially in France, which concerns itself with the manufacture of these substitution products, which are produced in the most remarkable ways. Glass beads, wax, fish scales and shellac, serve for the raw material and frequently products of great beauty are produced.

Such "pearls" are easily detected by the skilled technician as falsifications. If there is any doubt about it, a microscopic examination of the surface is necessary which brings with it absolute certainty. Pearls coming from the mollusks, the pearl oyster and mussel show a characteristic linear structure (Fig. 7), while the artificial product (Fig. 8) does not show it. If there are any grounds for doubt after this test, then a determination of the specific gravity follows or a chemical analysis of the material of the pearls. In all cases it is definite and easy to recognize such pearls as absolute falsifications.

But the detection of the so-called Japanese cultivated pearls, called for short Japanese or bred pearls is not so easy. As the name discloses, these pearls are raised as it



One method of examining pearls with a microscope: The perforated pearl by means of a special periscope apparatus is examined to detect the line of separation between bead and pearl layer. M, microscope, S, periscope rod. Fig. 2.

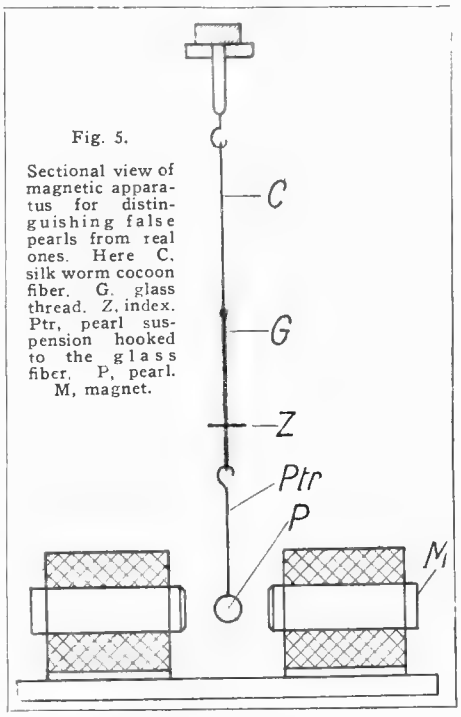


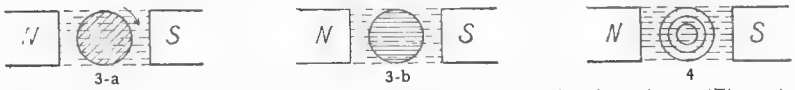
Fig. 5.

Sectional view of magnetic apparatus for distinguishing false pearls from real ones. Here C, silk worm cocoon fiber. G, glass thread. Z, index. Ptr, pearl suspension hooked to the glass fiber. P, pearl. M, magnet.

uncertainty which has existed for some time and has affected unfavorably the trade in pearls. Neither buyer nor seller are sure that pearls called natural are really such and not the cultivated pearl.

There has been, however, no lack of attempts to find ways to distinguish with certainty the cultivated pearl from the real.

Above all, two experiments have been made known both of which show certain disadvantages and do not always reach the goal. One, due to the American, Wright, uses the translucency of the Japanese mother-of-pearl bead for rays of light. A little bead turned on the lathe out of the substance of the pearl oyster shell shows clearly its



3-a 3-b 4

Pearls between the poles of a magnet. A cultivated pearl placed as shown (Fig. 3a) rotates until the layers of the mother-of-pearl bead are parallel with the lines of force of the magnet (Fig. 3b). If a round pearl is suspended in a magnetic field and it does not move, whatever its position, there is no mother-of-pearl bead within it. (Fig. 4.)

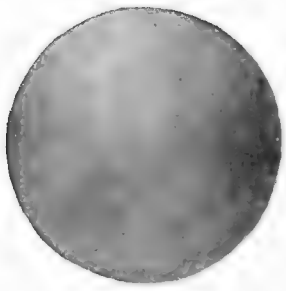


Fig 8.

The appearance of an artificial pearl under the microscope is shown at the left, and it will be observed at once that no striations or bands appear in this case. This is one of the outstanding differences between the false and real pearls.

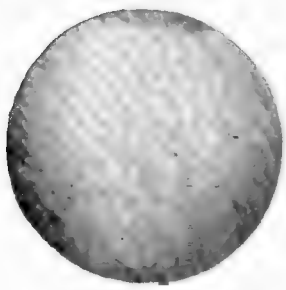


Fig. 7.

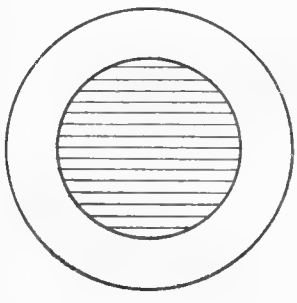
At the left we see how striations or bands appear when viewing a real pearl under the microscope. These striations or bands are not found when examining an artificial pearl.

were from seed. The process is carried out in this way. Little beads of mother-of-pearl are put into a mollusk. It is then restored to the sea, and left to itself. All goes on in this process as if a natural pearl were being formed. The little bead of mother-of-pearl in the course of some years is coated with pearl-substance and the artificial pearl eventually resembles perfectly the real one, but nevertheless, the bead of mother-of-pearl within the pearl indicates an interference of mankind in the processes of Nature. As is well known, the real pearl is the result of an accidental foreign body which gets into the oyster. The cultivated pearl on account of the way it is produced and its external appearance, can hardly be designated as a counterfeit because it is in a certain sense, to be compared with synthetic jewels, such as the synthetic ruby.

This is no place to consider the monetary value of such products. Nevertheless, it is to be noted that the Japanese pearl costs about one-third as much as the real. This condition, and the difficulty of distinguishing one from the other, leads to a state of

structure. It is built up of parallel even layers and lets rays of light which are parallel thereto pass through with greater intensity than those which fall upon the layers perpendicular thereto. If we look through a Japanese pearl which consists of

(*Continued on page* 468)

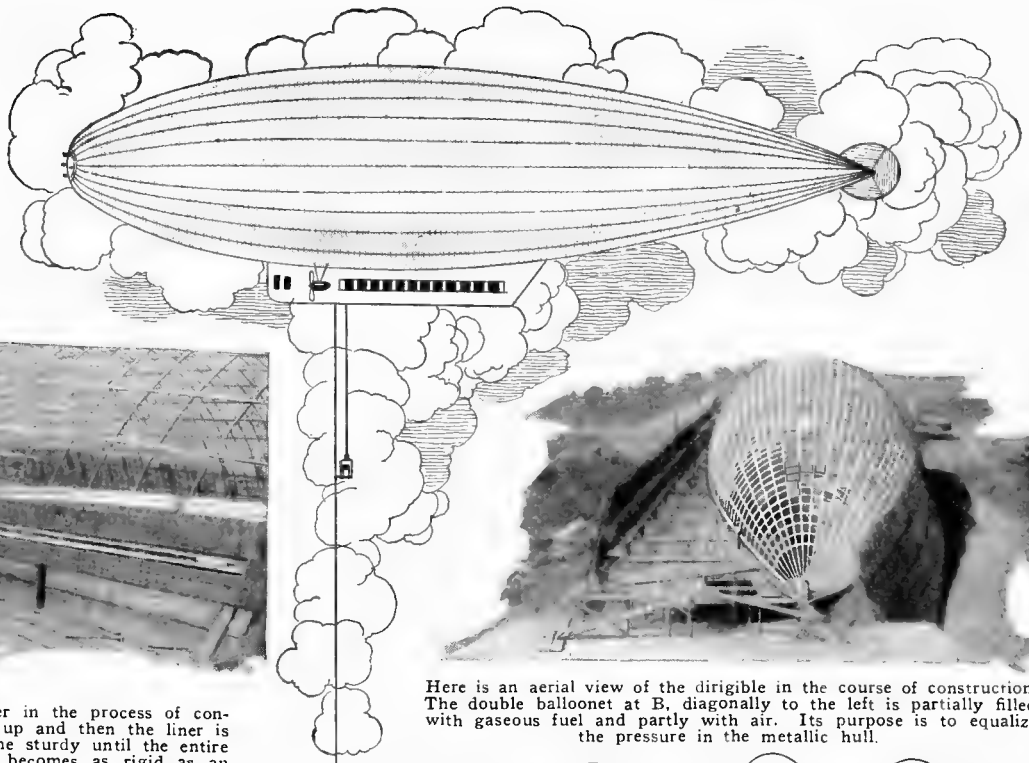


Sectional view through a cultivated pearl which is formed of a mother-of-pearl bead surrounded by a natural growth of pearl substance, which process is carried on by placing a small bead of real mother-of-pearl in a mollusk, and then restoring the mollusk to the water and the pearl is left to grow. The mother-of-pearl shows striations or layers.

Fig. 1.

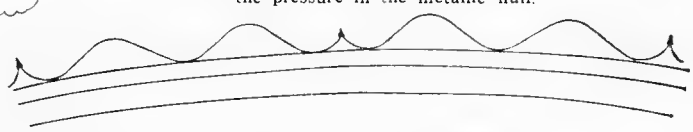
All-Metal Air Liner

By EDWIN SCHALLERT

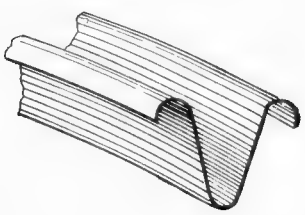


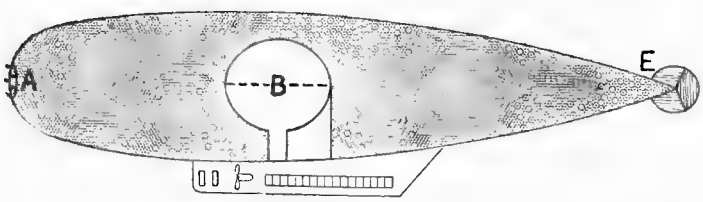
The above photo shows the all-metal liner in the process of construction. The girder work is first built up and then the liner is gradually developed but it will not become sturdy until the entire body is completely built, after which it becomes as rigid as an egg shell.

Here is an aerial view of the dirigible in the course of construction. The double balloonet at B, diagonally to the left is partially filled with gaseous fuel and partly with air. Its purpose is to equalize the pressure in the metallic hull.



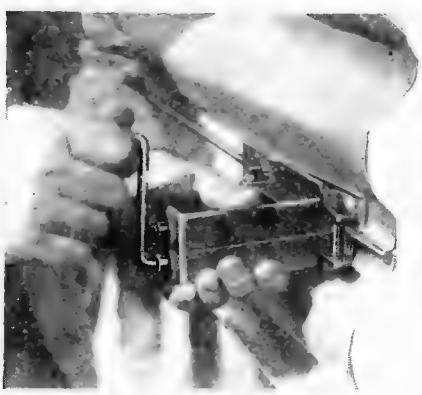
The finished air liner has sides of metal which are held together by U shaped metallic strips. The seams are caulked with a viscous liquid. Corrugations are .011 inch thick and are duraluminum. The airship is 200 feet long.



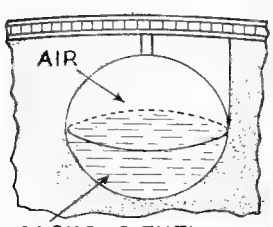


Here is a view through the air liner showing the air propeller at A, the gaseous fuel container at B and the rudder at E.

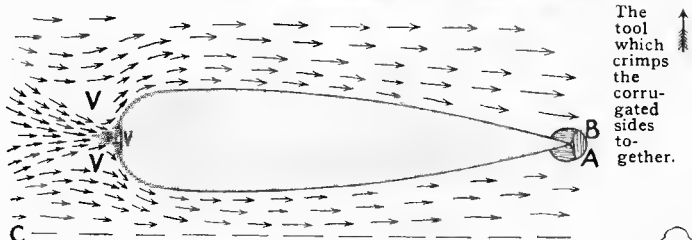
A photograph of the blower, A, is shown diagonally to the right. There are two auxiliary propellers on the body.



Thomas Slate with a working model of the all-metal dirigible.



This double balloonet is a very important feature of the construction. There are two compartments separated by a fabric diaphragm.



The tool which crimps the corrugated sides together.

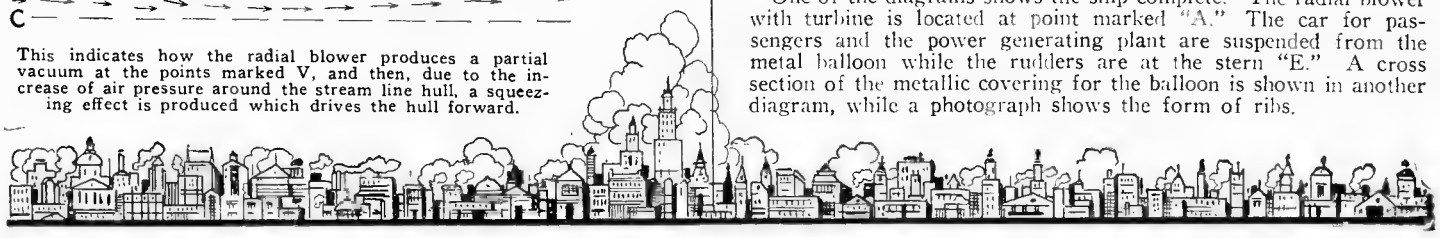
This indicates how the radial blower produces a partial vacuum at the points marked V, and then, due to the increase of air pressure around the stream line hull, a squeezing effect is produced which drives the hull forward.

AN air craft capable of transporting passengers speedily and landing them with reasonable safety in the midst of a humming metropolis has long been the goal of those interested in aeronautics. And the possibility of such a fulfillment is forecast in an invention now in process of development at Glendale, Calif., for which Thomas W. Slate is sponsor. He is constructing an all-metal dirigible there, which embodies novel features of propulsion and general design which are illustrated here.

It is asserted among other things that the new craft will make possible thirty-six hour Pullman passenger service between New York and Los Angeles, and thirty-four hour service between New York and London. This new air liner will be capable of attaining a speed in excess of 108 miles an hour, and will have an elevator landing device. It will be steam driven.

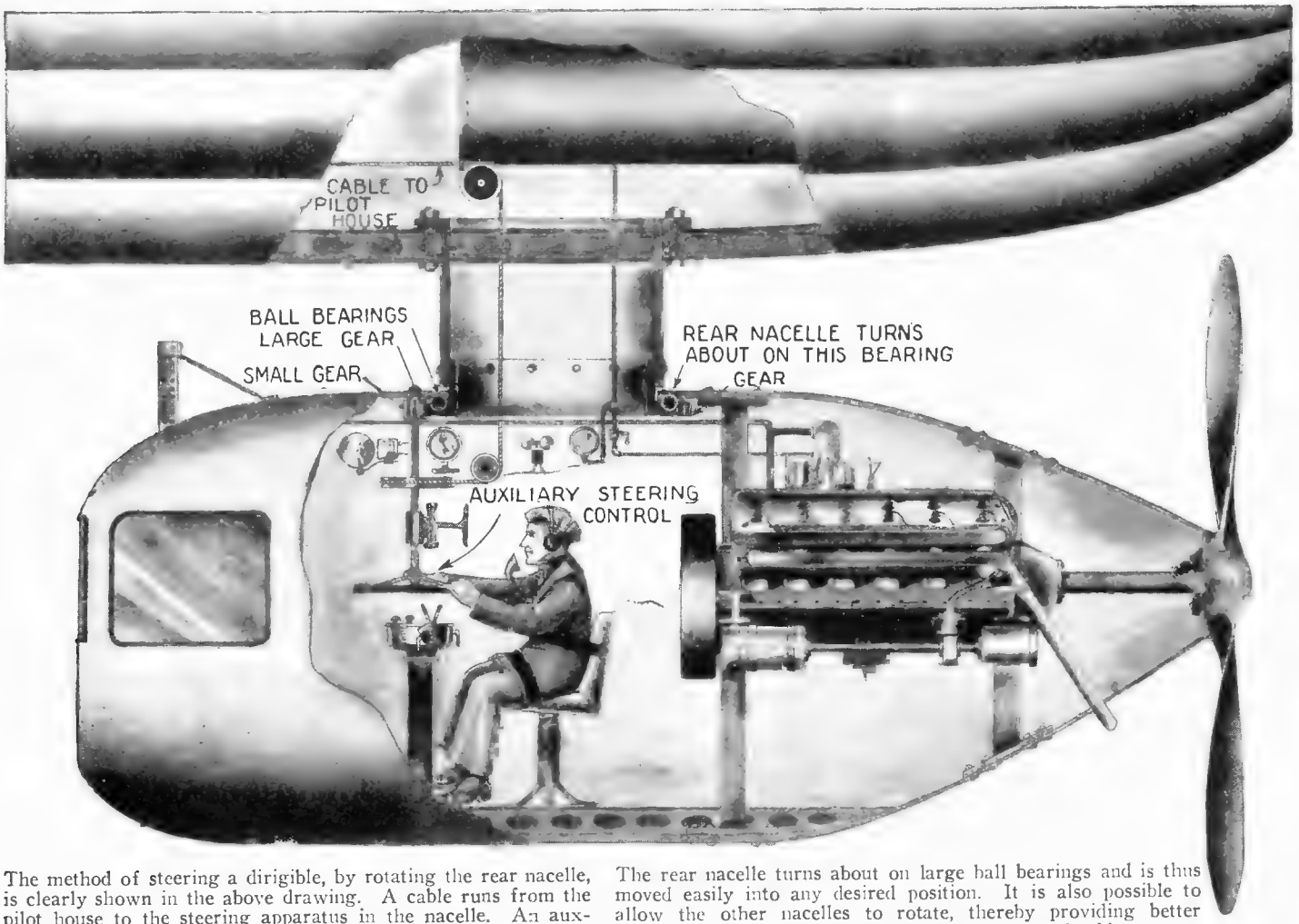
The photos show the ship in process of construction. It is built on the egg-shell principle. Longitudinal beams are eliminated. The frame is made up of circular ribs, to which are attached corrugated strips of metal running the entire length of the ship. These corrugated strips are brought together in air-tight seams.

One of the diagrams shows the ship complete. The radial blower with turbine is located at point marked "A." The car for passengers and the power generating plant are suspended from the metal balloon while the rudders are at the stern "E." A cross section of the metallic covering for the balloon is shown in another diagram, while a photograph shows the form of ribs.



It is proposed that the all metal air liner will at no time decend to the ground, except for serious repairs. The illustration above shows a plan view of a city with a dirigible anchored. Along this anchor line an elevator car is to slide, to permit passengers to depart from the vessel, and likewise to take on new passengers and fuel. The ship will be maintained at an altitude of approximately 1000 feet and safety devices are provided so that in event the dirigible bobs up and down in the air, no perceptible effect will be noted on either the anchoring cable or the elevator.

Dirigible Steering Device


CABLE TO PILOT HOUSE
BALL BEARINGS LARGE GEAR
SMALL GEAR
REAR NACELLE TURNS ABOUT ON THIS BEARING GEAR
AUXILIARY STEERING CONTROL

The method of steering a dirigible, by rotating the rear nacelle, is clearly shown in the above drawing. A cable runs from the pilot house to the steering apparatus in the nacelle. An auxiliary steering control is also provided.

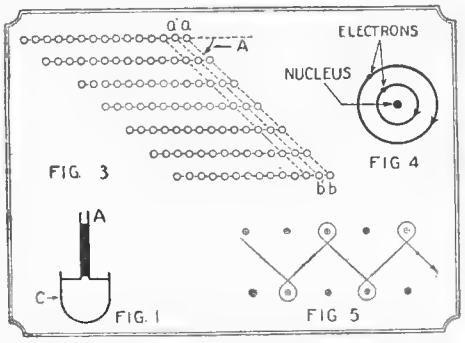
The rear nacelle turns about on large ball bearings and is thus moved easily into any desired position. It is also possible to allow the other nacelles to rotate, thereby providing better control.—*Contributor please send name and address.*

Making Single Metal Crystals

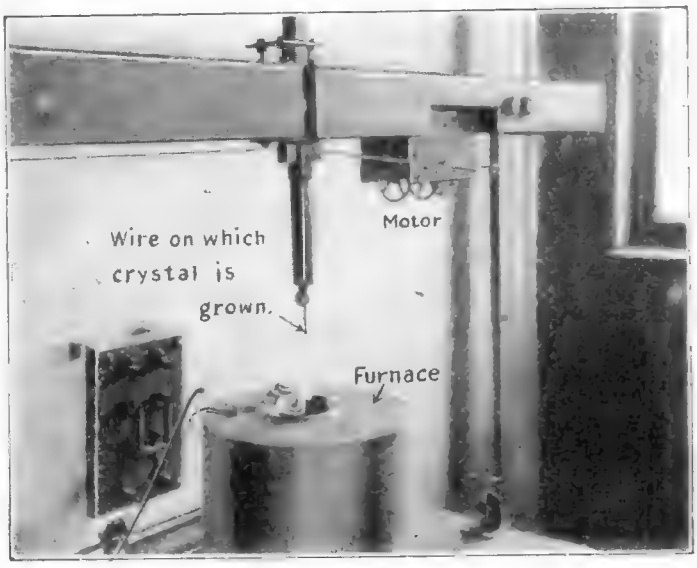
By ERNEST G. LINDER
Dept. of Physics, State University of Iowa

RECENTLY some unusual investigation has been carried out on what are called single metal crystals. It is common knowledge that sugar and quartz, for example, are crystalline, but it is not so commonly known that metals also are. The fact is, that all metals are crystalline, and that even iron nails, gold rings, and steel I-beams are but conglomerations of minute crystals, which, if they could be isolated and magnified, would be seen to have all the beautiful symmetry and geometric regularity of the finest specimen of crystalline quartz or calcite. The modern scientist, with his patient search for better methods for discovering the truth, has perfected an instrument with which he can produce extraordinarily large crystals of metal.

Fig. 1 shows the furnace retort. Fig. 3 the molecular lattice of crystals. Fig. 4 shows the normal path of electrons about the nucleus, while 5 shows them in an electrical field.



THE essentials of this interesting process are illustrated in the photograph. A melt of metal from which crystals are to be made is contained in a crucible and kept just a few degrees above the melting point by electric heating coils. By a suitable mechanism a wire is dipped into the melted metal and slowly withdrawn at the rate of 10 mm. or .4 of an inch per minute. A thick thread is drawn up, which rapidly solidifies, forming a single crystal. Investigation proves that the thread thus obtained is composed of one single crystal of the metal from which the thread was drawn.



The photograph at the left shows the apparatus used by the author in producing metallic crystals of the type described. Single metal crystals from one to two feet long and about ⅛ inch in diameter may be easily produced by this process. Czochralski, a German physicist, is credited with its discovery.

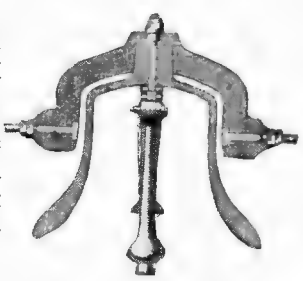
The Romance and Casting

By EDNA MAC

Do You Know How Bells Are Cast and Tuned?

The insert in the illustration at the left shows how the bells are controlled by levers, connected with rods, running to the bell tower. The control board is usually placed under the bells, so that the connecting rods will be straight, but in some cases it is necessary to use jointed rods.

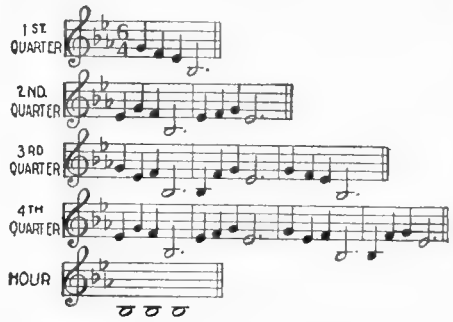
ALMOST unusual industry flourishes in my neighborhood; it is the manufacture of bells. These bells are made by a well-known concern in Troy, New York, a firm consisting of a father and three sons, whose ancestors cast the first bells made in America. It is this firm that made the four large bells which hang outside the 46*th* story of the fifty-story Metropolitan Life Insurance Tower in New York City, and which are said to hang twice as high above the ground as any others in the world. These bells are of the following weights and tones: 1500 lbs. G; 2000 lbs., F; 3000 lbs., E Flat; and 7000 lbs., B Flat. Four notes struck at the first quarter, eight at the second, twelve at the third, and sixteen at the hour, followed by the hour stroke on the large bell, produce the famous "Cambridge Quarters," originated by the great musician-composer, Händel. The motive power is derived from mechanism operated by the tower clock.



The method of mounting bells is shown in the illustration at the right. They are supported from the top because at this point there is the least vibration. The supporting frame is arranged to swing so that the bell may be tolled.

The distance at which these bells may be heard is greater than that of any other bells. Situated at the top of the tallest structure in the world holding bells, ten times higher than the average church bell, the sound waves are unobstructed. Voyagers at sea, and far up the Hudson River, over twenty-eight miles from the tower, frequently report hearing these bells. And yet so musical and soft are the tones, that visitors to the observatory gallery, one story beneath them, listen to them with the greatest pleasure. These famous "Cambridge Quarters" are struck as shown in center column.

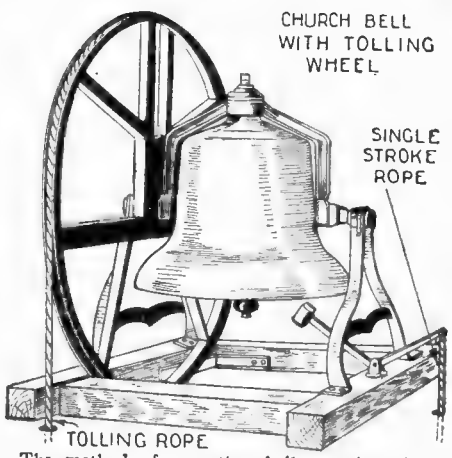
No one seems to have been able to trace the origin of bells; they have been known from the earliest times, and are mentioned in the works of the most ancient writers.

Very likely, bells, so-called, were at first not much more that simple pieces of metals, concave in shape, the sounds of which were found very pleasing and their use easily and simply adapted to meet the needs of people as they do today. It is not absurd to conclude that bells do really belong in the realm of antiquity when it is a fact that a very old painting depicts David playing upon a number of bells hung up before him; and that Noah is reported in ancient manuscripts as calling the carpenters to work with bell sounds, when engaged in constructing his Ark.

The notes struck in the famous "Cambridge Quarters" are shown in the above illustration. It will be seen that a different tune is played at each quarter of the hour.

Also, it appears that bells were universally known, as well as anciently. Rude tribes, isolated inhabitants of almost unknown isles in but slightly charted seas, have been found to possess bells. They were known in America before its discovery by Europeans because Indian traders brought some in their canoes to Columbus, at Honduras. And bells, probably the oldest in the world, were found in the palace of Nimrod, in Assyria.

It is commonly accepted that the word *bell* has been derived from the far East, where they call the Sun, lord of all things, Baal or Bel; and that Anglo-Saxon usage has combined the idea into BELLAN, meaning "to roar"—hence, our word of today "bells."

Small sized bells, the first to come into use, are referred to by Moses in the book of Exodus. These bells were attached to the vestment worn by the high priest in the sanctuary; by the prophets Isaiah and Zachariah, bells are mentioned as being attached to the feet of women, and hung around the necks of horses. The ancient Persians decorated their costumes with bells, and in ancient Egypt and other Eastern cities, girls wore strings of bells about their ankles the same as they do today.



The method of mounting bells so that they may be tolled or rung individually, is shown in the above illustration.

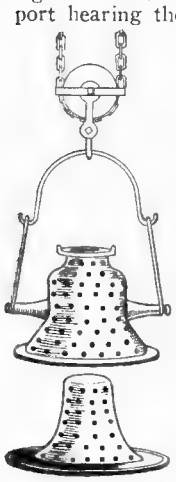
Bells were used in Greek camps, hung in triumphal cars, sounded in the markets, proclaimed feasts, and were often hung in their temples. Romans sounded bells to assemble families, and to announce hours of public business. Shepherds, from time immemorial, have hung bells upon their sheep. The old belief had it that they grew fat if properly adorned with a bell. The distant cow bells in Switzerland give a most harmonious effect.

Large bells were first made by Christians, for religious worship, although bells of lesser sizes were undoubtedly used in China for religious practices, two thousand years before the Christian era.

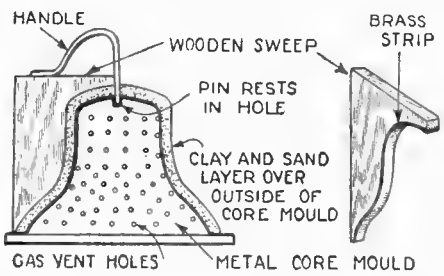
We read of bells being used as early as 400 A.D., in Nola, Italy, by the Bishop of Campania. It is certain that the introduction of bells into church turrets as part of religious usage is the direct cause of the distinct type of church architecture, with its steeple, which became established with Christian forms of worship. And as it is today, bells were regarded as being vitally necessary to every church edifice. In America we may take the unwritten law more poetically, but it is written into the laws of the Church of England that "parishes must furnish bells and bell ropes."

Thus it has come about that bells have acquired a sacred character. In the ancient days, the casting of bells was attended with elaborate religious ceremonials. Today, bells are blessed by Roman Catholics with solemn ceremonies.

The custom of naming and giving sponsors

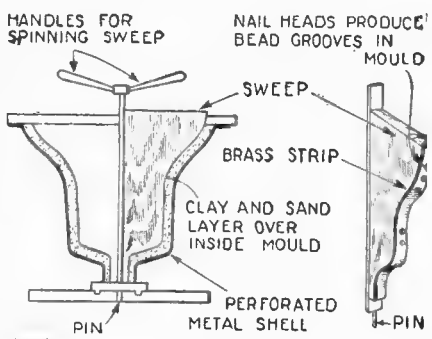


The illustration on the left shows the molds used in casting bells. The inside of the upper one and the outside of the lower one are coated with an even layer of clay and sand. The molds are then clamped together and the bell metal is poured in from the top. The metal molds are perforated so that the gases generated when pouring, will not pit the bell.



The method of obtaining an even layer of clay and sand on the mold is shown in the above illustration. A wooden sweep is constructed exactly the shape of the inside of the bell, and a brass strip is fastened on the edge so that a clear, even clay mold is formed.

On the outer half of the mold, a sweep is pivoted exactly the shape of outside of the bell. In this case, to facilitate pouring the clay, the metal mold is placed up-side down. Decorative bead grooves around the bell are formed by driving brass headed nails into the edge of the sweep strip. The method of using sweeps instead of wooden molds in making the casting molds, insures perfectly symmetrical walls on the bell.



# of World-famous Bells

DONALD SERREM

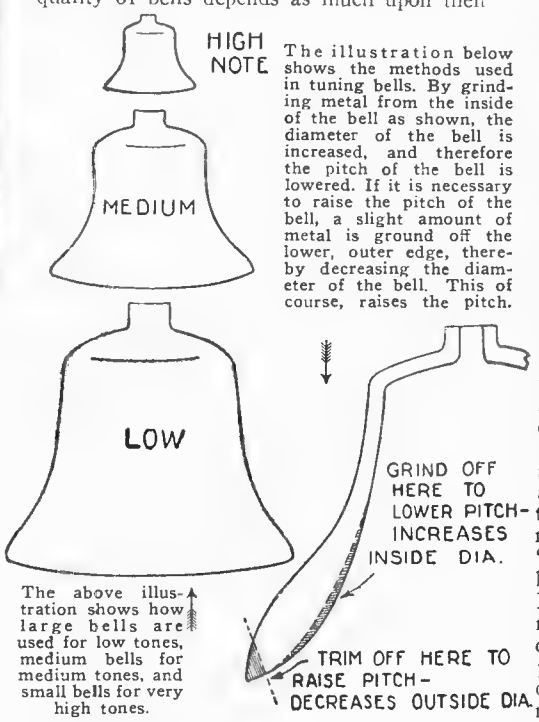
Method of Molding, Casting and Tuning Bells Explained

Tuning forks are sometimes used in tuning bells, but when groups of bells are made, the experienced ears of the bell makers are usually relied on.

to bells is an ancient one, but continued today in varying forms; the sponsors then, as now, usually being persons who have been active in the donation of the bells.

Certain names become attached to bells because of the service which they perform for the church or community. We have, thus, the ANGELUS BELL, tolled three times a day. When its notes are heard, people must recite the Angelus, and fall into meditation and prayer. The VESPER BELL, tolling later, calls to evening prayer. The PASSING BELL was tolled long ago, and is still to this day in certain sections of the world, when anyone was passing out of life, so that anyone who heard it might pray for that soul. The CURFEW BELL, "tolls the knell of parting day," and the custom of sounding it is continued in many countries. The TOCSIN, or alarm bell, was suspended in castles and fortresses in the old days. Its ringing announced the approach of the enemy. Bells are still employed for alarm purposes, as we know, particularly to report fires. Longfellow speaks of the Florentine battle bell brought out upon the battle field.

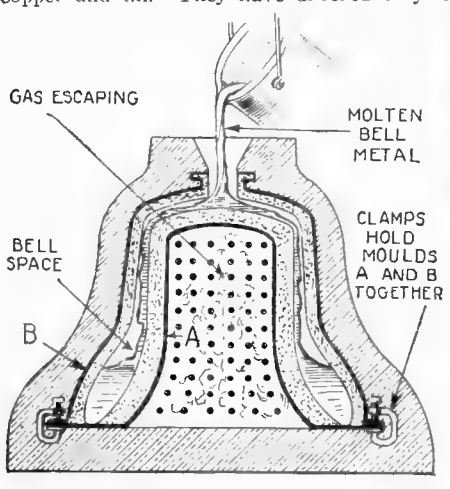
The metals employed in the making of bells have always been the same; namely, copper and tin. They have differed only in the proportions used. It has been clearly proven by the long experience of the ancients, as well as by the careful tests of later years, that these are the only metals capable of producing a proper ringing alloy. Injury to the tone has invariably resulted when iron and steel, or even silver and gold, have been introduced into the composition of bell metal. Harsh and disagreeable sounds are produced by the iron and steel; and gold and silver give a dead sound, since they are not resonant, being more of the nature of lead where this quality is concerned. Of course, the quality of bells depends as much upon their shape and the proper proportions of height, width and thickness, as upon the nature of the composition.


HIGH NOTE
MEDIUM
LOW
GRIND OFF HERE TO LOWER PITCH- INCREASES INSIDE DIA.
TRIM OFF HERE TO RAISE PITCH- DECREASES OUTSIDE DIA.

The illustration below shows the methods used in tuning bells. By grinding metal from the inside of the bell as shown, the diameter of the bell is increased, and therefore the pitch of the bell is lowered. If it is necessary to raise the pitch of the bell, a slight amount of metal is ground off the lower, outer edge, thereby decreasing the diameter of the bell. This of course, raises the pitch.

The above illustration shows how large bells are used for low tones, medium bells for medium tones, and small bells for very high tones.

Vibrations make the tone of the bell. A bell changes shape, when struck, and the repetition of these changes constitute its vibrations. The diameters of bells correspond to the lengths of musical strings.



The completed mold, clamped into place, is shown in the illustration on the left. The metal is poured from the top, slowly, so that it will run right to the bottom without leaving any gas holes. The escaping gas passes through the porous clay and the perforations in the metal case.

This illustration shows the actual pouring of a bell. The mold with its bucket-shaped funnel is clearly shown. The pouring bucket with its swivel support and crank may also be seen. The man on the left is tilting the pouring bucket over the funnel so that the metal will run slowly into the mould.

The "Great Bell of Moscow," or Czar Kolokol is, by far, the largest bell in the world. Its approximate weight is 492,800 lbs. and its cost, in bell material is estimated at $340,000, to which, more than a million dollars were added in precious jewels.

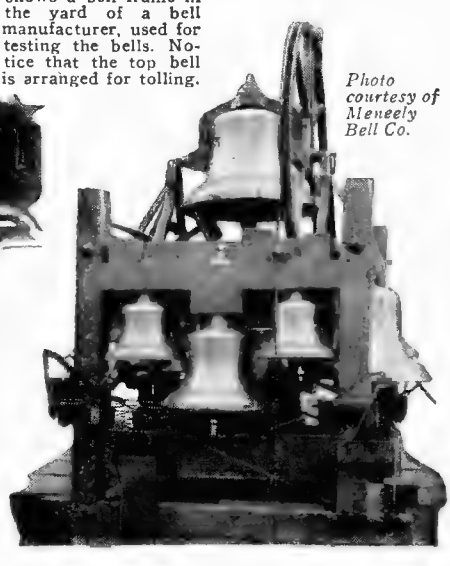
Like all sounds, practically, bell tones are reflected; and there is a force in their sound waves of considerable amount. There is told the story that Swiss muleteers tie up their little bells when passing through certain places in their mountains, to guard against their tinkling which might affect the delicately poised snow and bring it down upon them in an avalanche—thus sound waves from bells.

England is called "The Ringing Isle" because of its many bells, and the skill and beauty with which they are rung. The ringing of bells requires great experience and skill, if it is done adequately. England has made a study of bells; it has become a national art. In France it is the custom throughout the vinelands, to ring bells when storms threaten so as to break the thunderclouds.

Russians regard the sound of bells as summons to worship, of course; but also as a distinct part of their worship. They never tire of ringing their heavy bells, and they are most extravagant in procuring them. The "Great Bell of Moscow" or the "Czar Kolokol" is by far the largest bell in the world. It weighs about 492,800 pounds, and its bell material cost $340,000, to which was added over a million dollars in precious stones, plate, etc., by nobles, when it was cast. Its dimensions are nineteen feet in height and nineteen feet in diameter. It is not suspended, having fallen to the ground at one time when the beams supporting it were destroyed by fire, which resulted in a break in one side. It was raised by Emperor Nicholas and placed upon a low wall in the Kremlin. It was cast in 1733, and has always been most carefully guarded.

There are really innumerable bells through-

(*Continued on page* 451)



The illustration below shows a bell frame in the yard of a bell manufacturer, used for testing the bells. Notice that the top bell is arranged for tolling.

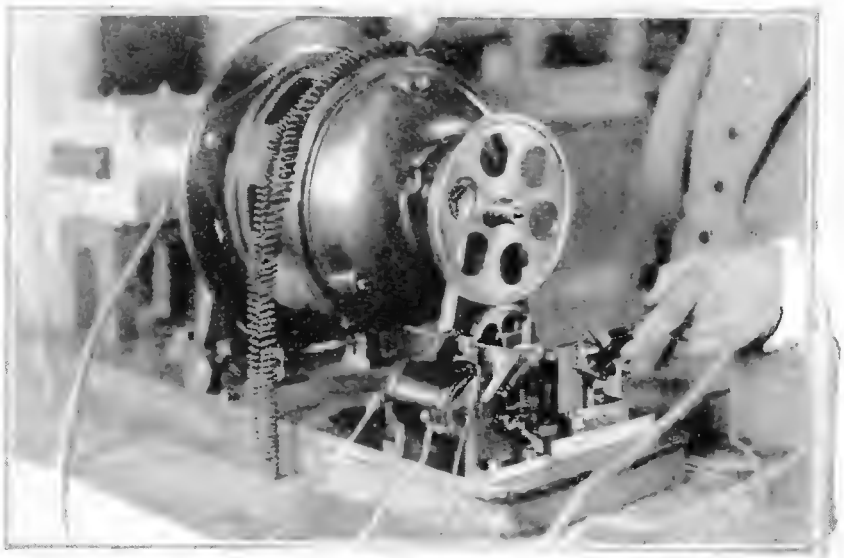
Photo courtesy of Meneely Bell Co.

Television Developments of Edouard Belin

Some of the Newer Apparatus Devised by Belin Is Described in This Article

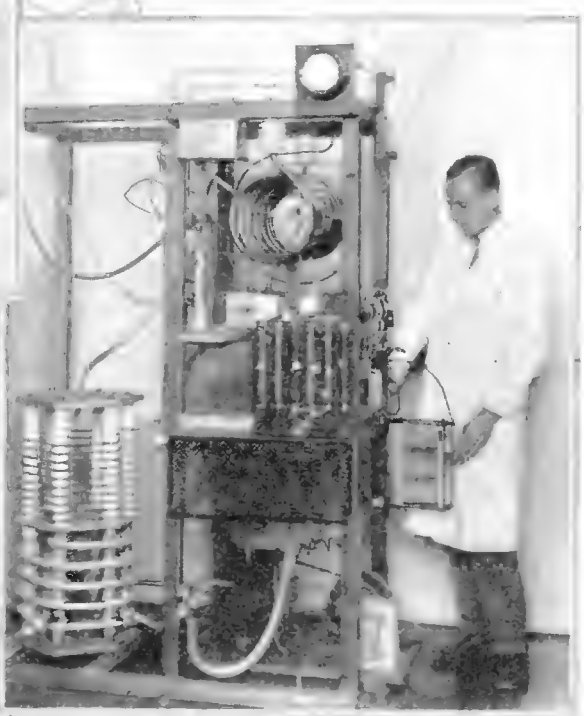
MONSIEUR EDOUARD BELIN, one of the earliest of those who for the past twenty-five years have been working diligently in their laboratories in an effort to solve the problem of transmitting the living image of a person over an electric circuit, has developed some new apparatus to improve the methods now used. Monsieur Belin has turned to the cathode oscillograph (special vacuum tube) for his television receiver. The transmitted impulses, which have been changed from light to electric current by the photo-electric cell, are passed through electro magnets in the receiving circuit. These magnets produce a varying electric field, through which the *electron stream,* forming the light spot on the oscillograph "lens" passes, and thus create a consequent variation with the changes in the field. This value, of course, is in turn equal to the variations of the original light variations at the transmitter.

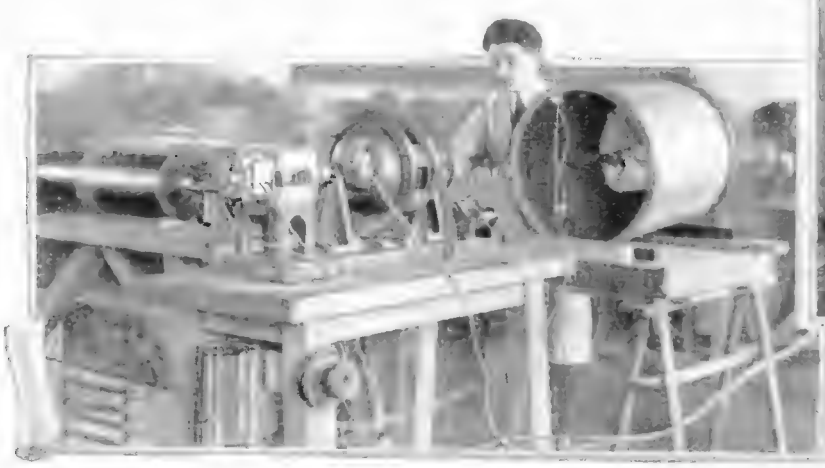
Two oscillating mirrors are used to reflect the light used to scan the image. One mirror oscillates vertically and the other horizontally. The speed of oscillation is 600 times per minute vertically, and 12,000 times per minute horizontally. To maintain a perfect vacuum in the cathode oscillograph, Monsieur Belin uses a Holweck helisoidal pump and to transmit most effectively by radio, he has found the short waves best. The transmitter shown in one of the illustrations on this page, is designed to operate on wave lengths from 250 meters to about 30 meters. In this transmitter, he uses a water cooled vacuum tube, to keep down excessive heating on the lower waves.



The two oscillating mirrors which cause the light beam scanning the image, to oscillate vertically and horizontally, are shown beside the finger in the above illustration. The mirror designed to move vertically, oscillates 600 times per minute, and the horizontally moving mirror oscillates 12,000 times per minute. The large dynamo and gears used by Monsieur Belin are also shown in this illustration. Behind the dynamo can be seen the arc light used to produce the light spots that search the image. The large spring, which holds the generator in place, may also be seen in the photograph. The second disc gear appearing under the large gear is used to oscillate the mirrors.

The magnets used to vary the electric field, through which the electron stream in the cathode oscillograph passes, are shown at the right of the above illustration. The vacuum pump used to keep the cathode ray tube in operation, can be seen at the left.



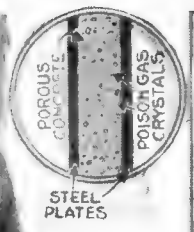


The short wave transmitter used by Edouard Belin in his television experiments, can be seen above. On the left may be observed the complete television apparatus.

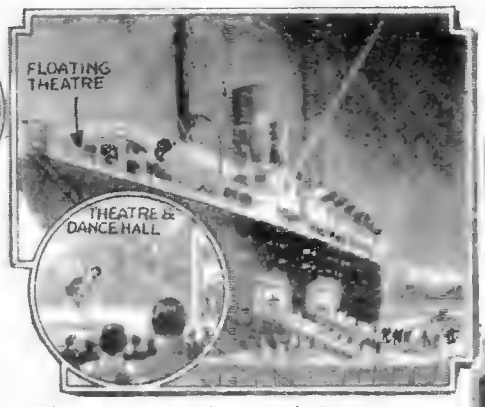
Although television is not yet practical for every day use, it is taking rapid strides towards that end. It will take a few years to develop the apparatus, but if the improvement continues as rapidly as it has in the last year or two, we will soon be using television apparatus on our telephones, radios, and for a number of unthought of uses. The recent experiments of the Bell Telephone Laboratories, which were described in the June, 1927, issue of this magazine, the developments of Lucien Fournier described in the July issue, the recent achievements of Baird (see June, 1927, RADIO NEWS) and all the other diligent experimenters and inventors have certainly produced very interesting and valuable results.

The Month's Scientific News Illustrated

By GEORGE WALL

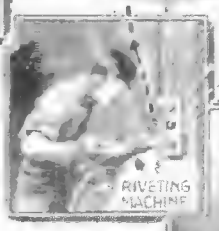


Yeggmen are likely soon to be exposed to gases more poisonous than ever used in the World War. A German inventor has developed a safe which will produce such gases, the moment a drill penetrates the steel. Gas producing crystals are deposited in a bed of porous concrete between the steel walls. The crystals are said to evolve chlorine, carbon monoxide and hydrocyanic acid.

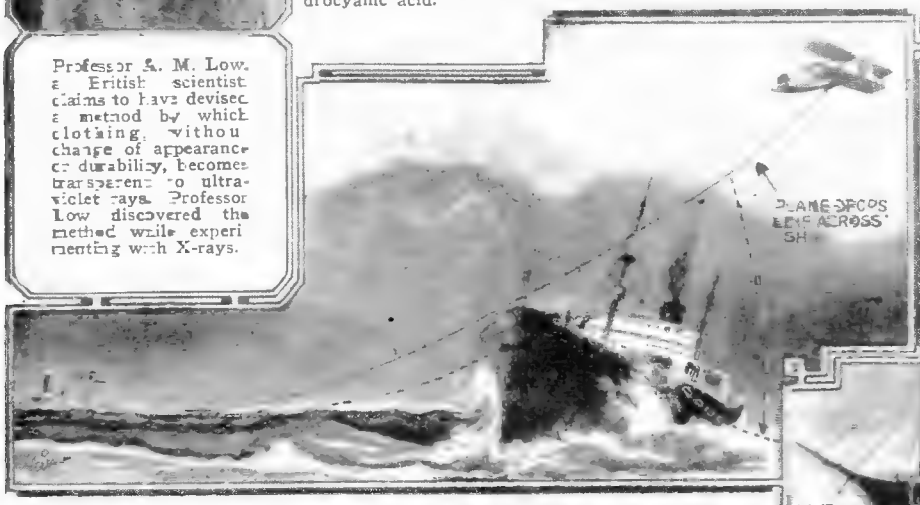


An original plan for theatrical productions has been developed by a Genoese industrialist. He has bought an obsolete liner and has transformed it into a floating theatre and dance hall. The new theatre will have a seating capacity of fifteen hundred. If the experiment succeeds, the floating theatre will travel to all large Mediterranean ports and possibly also to the principal harbors of the world. It will be interesting to follow the results of this experiment and it may be that many future theatres will be of the floating type.

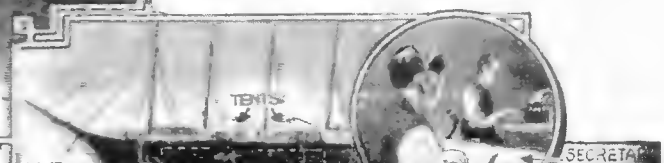
Professor S. M. Low, a British scientist, claims to have devised a method by which clothing, without change of appearance or durability, becomes transparent to ultra-violet rays. Professor Low discovered the method while experimenting with X-rays.

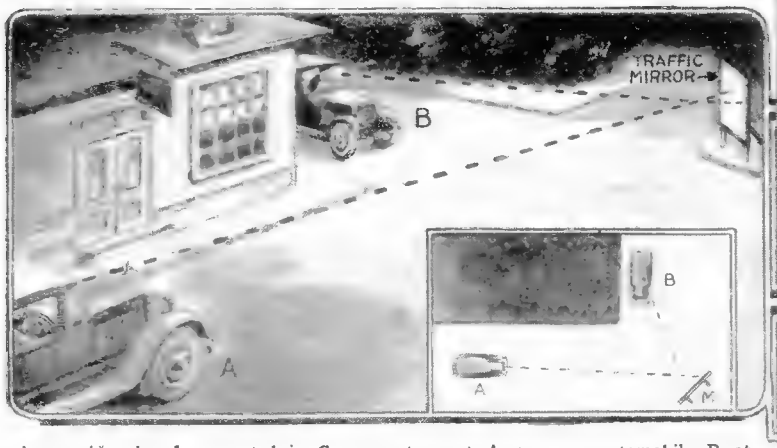


Invalids and night workers will have a chance to sleep during the daytime, if action is taken on the recent investigations of Health Commissioner Harris of New York. Having received complaints about the noise made by riveting machines near homes and hospitals, Commissioner Harris with the help of electric arc welding experts started an investigation. The unanimous opinion of these men was that the electric welding process of construction is superior to riveting. The results obtained are in most cases better than riveting and the process is entirely silent.

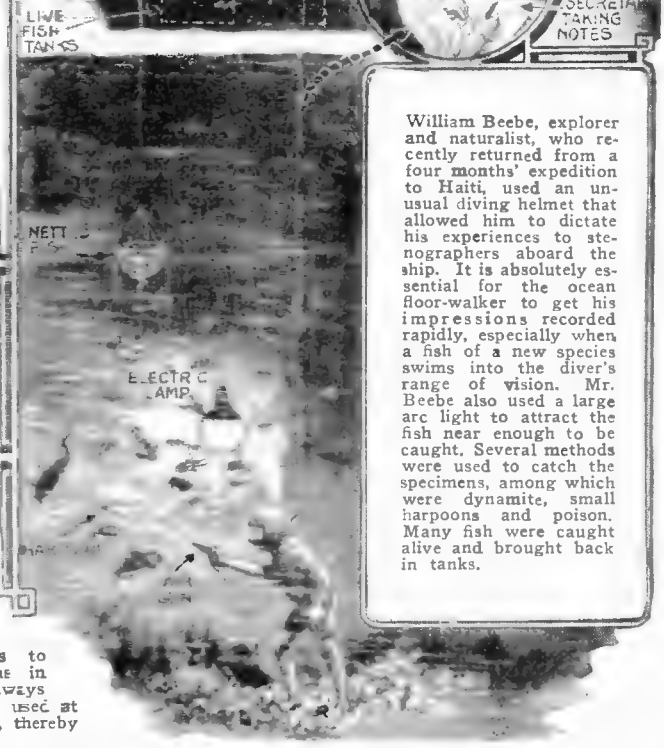


A life-saving innovation which makes use of an airplane in carrying a line to a ship has been tested successfully at San Francisco. A plane which took off from Crissy Field, flew out 4,000 feet over the bay, to a cutter anchored in the stream. As the plane passed over the ship, a line was dropped squarely athwart the decks. This system promises to be of great assistance in cases of ships running aground in high seas for using the breeches buoy.





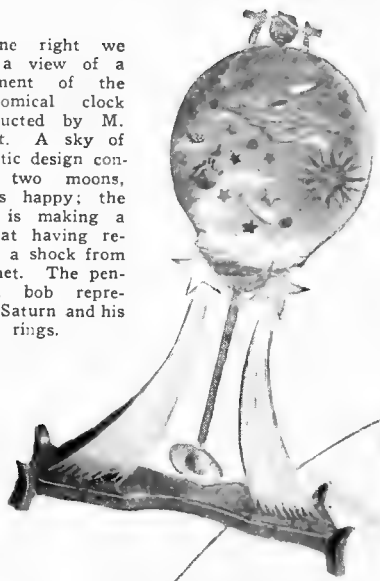
A new idea has been tested in Germany to prevent accidents at dangerous crossings. Large mirrors are being erected in Bonn, at the elbows of narrow L-shaped streets, so that the motorist can see the approach of an automobile around the corner. The mirrors, used to lessen the danger of blind corners, are known as "traffic spies." As may be seen in the diagram, the automobile at A can see automobile B at some distance from the corner, thus preventing an accidental collision. This system promises to make unpoliced corners safer, as in country districts where two highways cross. This method could also be used at city corners, where traffic is light, thereby reducing the traffic police force.



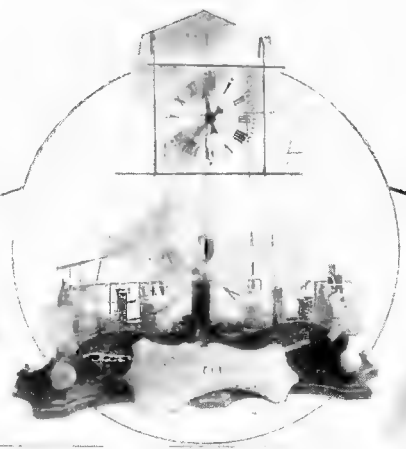
William Beebe, explorer and naturalist, who recently returned from a four months' expedition to Haiti, used an unusual diving helmet that allowed him to dictate his experiences to stenographers aboard the ship. It is absolutely essential for the ocean floor-walker to get his impressions recorded rapidly, especially when a fish of a new species swims into the diver's range of vision. Mr. Beebe also used a large arc light to attract the fish near enough to be caught. Several methods were used to catch the specimens, among which were dynamite, small harpoons and poison. Many fish were caught alive and brought back in tanks.

Mysterious Clocks from France

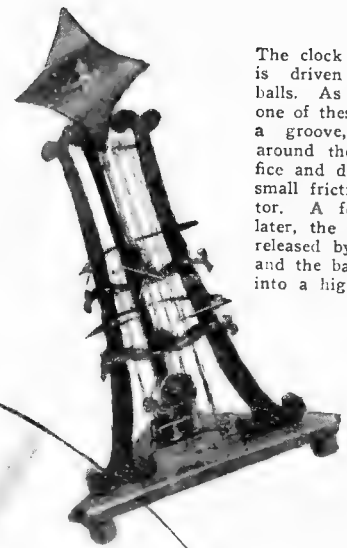
At the right we have a view of a movement of the astronomical clock constructed by M. Boulat. A sky of fantastic design contains two moons, one is happy; the other is making a face, at having received a shock from a comet. The pendulum bob represents Saturn and his rings.



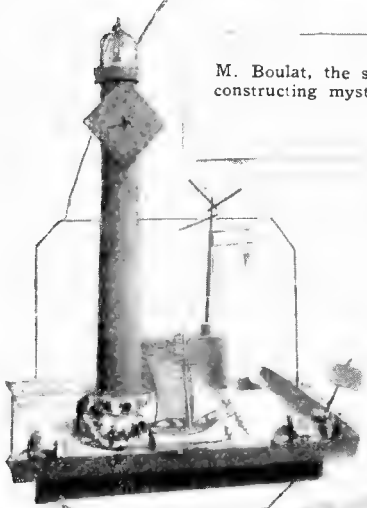
Below we have the physical-chemical clock whose hands indicate the time by a mobile glass in the back of the framework. In other words, the motive power is derived by chemical actions in the glasses at the base which supply the current by wire and cause the glass on which the hours are marked, to move around instead of the hands.

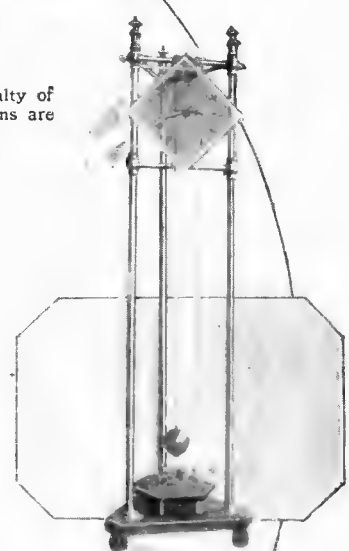


The clock at the left is driven by three balls. As it operates, one of these falls into a groove, goes all around the little edifice and drops into a small frictional elevator. A few seconds later, the fly-wheel is released by electricity and the ball is drawn into a higher groove.

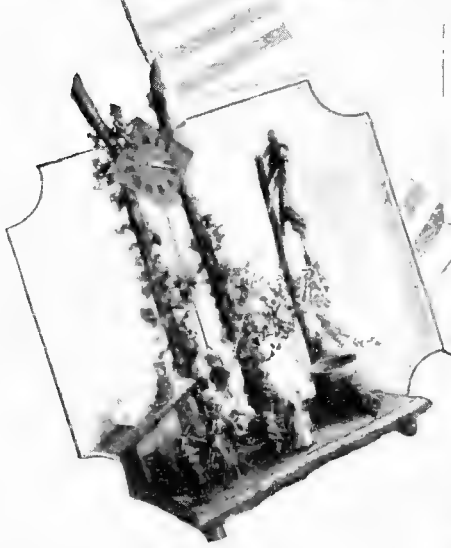


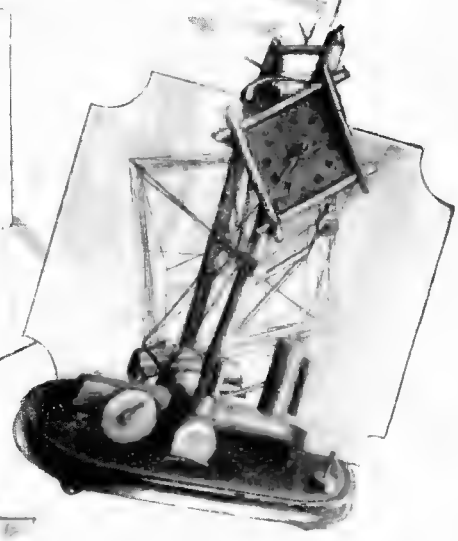
M. Boulat, the skillful French clock-maker who, for a long time, has made a specialty of constructing mysterious time-pieces, is shown in the photo below. His latest creations are illustrated on this page.

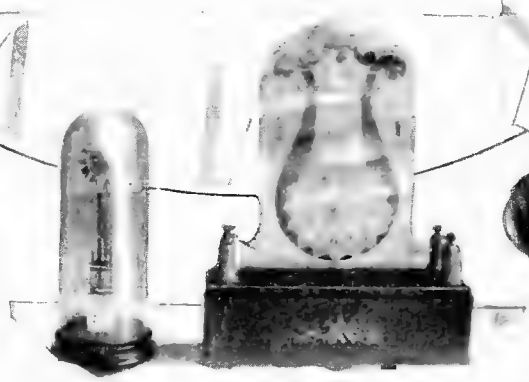




To the left of M. Boulat is a lighthouse which is built on a rock in the middle of a miniature sea. A small ship acts as if it were driven by a light breeze over the surface of the water; the surface painted in blue with foam and waves produces a very pretty effect. To the right of M. Boulat we have a clock with a conical pendulum.







Above we see the clock of the Allies, a stage piece of great effect. A German holds the Crown Prince tied up like a sausage. A mechanism hidden in the grass turns a windlass which pulls up two soldiers until they are hanging in the air, there is a click, and the two gentlemen fall into a tank of sauerkraut to emerge later. The mechanism was inspired by the World War.

Here are two models of the mysterious clocks which seemingly run on their own power forever. They are encased in glass and keep accurate time. These time-pieces have also been constructed with infinite care and patience, by M. Boulat.

A clock made entirely from a branch of tree, a skein of thread and a few newspapers is shown above. As in the case of all the other unusual time-pieces, this clock keeps excellent time, is simple in construction and has to be rewound only after long periods of running. It may well be termed, "The Rustic Clock."

How to Make a Magazine Holder

With a Little Patience, This Cheap, Effective Magazine Holder Can Be Made by Anyone

By H. L. WEATHERBY

The finished magazine holder is shown in the above illustration. Note how handy it is to anyone sitting in the easy chair.

ONE of the portable magazine racks as illustrated, will prove to be a most useful small piece of furniture as well as a delight to the eye of all those who behold it. Its construction is simple, and with the ordinary home tools, and a coping saw, which can be purchased for twenty-five to fifty cents, the building of it will prove to be a very pleasant and easy occupation for a few evenings at home.

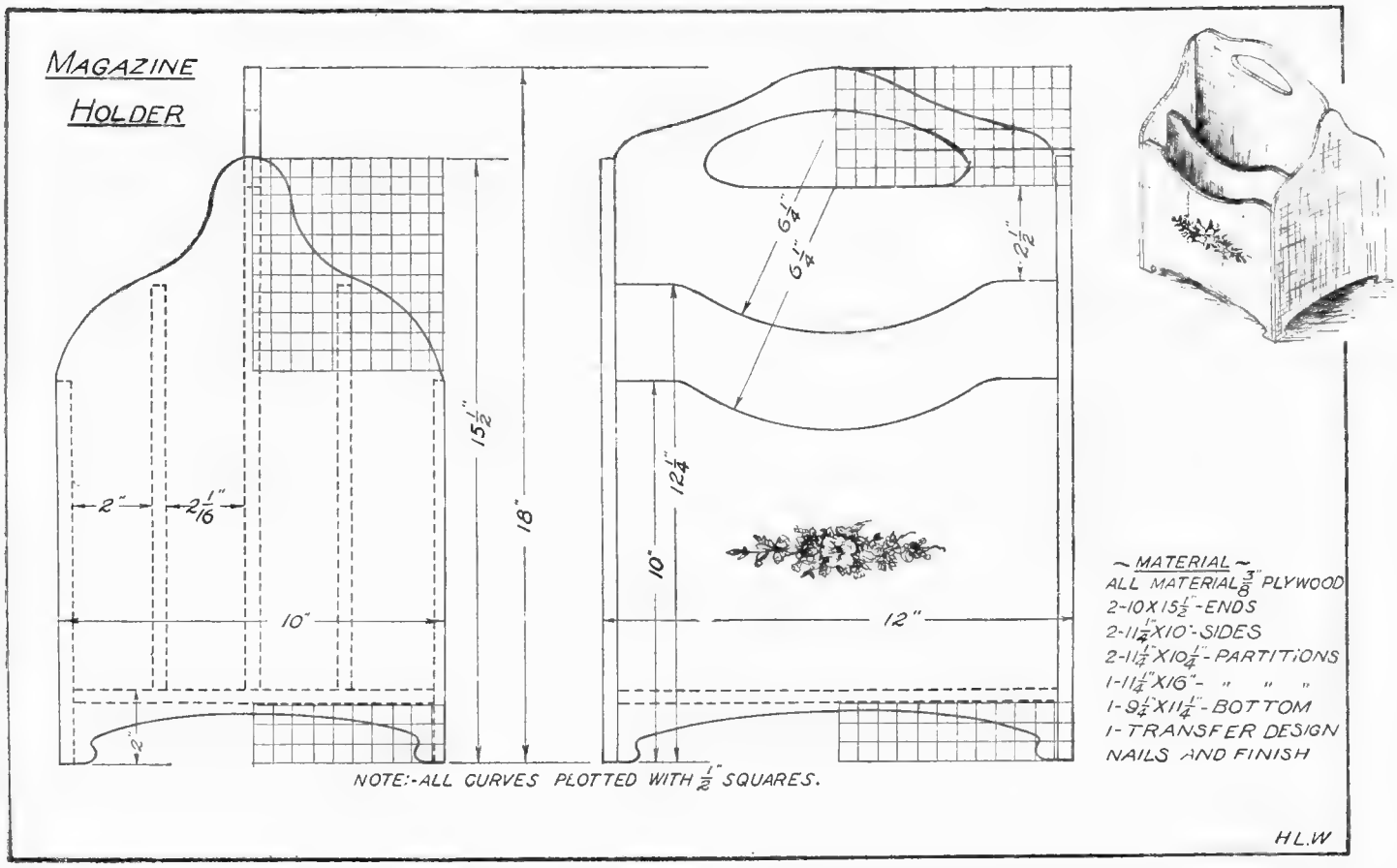
The construction is quite fully explained in the illustrations. Plywood is recommended although its use is not absolutely essential. In purchasing plywood, hand planing, scraping and most of the sandpapering is eliminated. The cheaper grades of three ply material may be used, if the finished article is to be painted, and with the present popularity of enamels and lacquers, that kind of a finish is recommended. With the Chinese red or jade green lacquer, trimmed on the edges in gold, and with Chinese "Decalcomania" transfer designs front and back, the finished piece will compare most favorably with those seen in the furniture stores and at a fraction of the cost, besides all of the fun to be had in building. The itemized cost of the ones illustrated is about as follows: wood $.50, lacquer, .50, transfer designs .40, nails, sandpaper and filler .10, bringing the total to approximately $1.50.

Two views of the finished magazine rack are shown above. Any number of designs can be worked out and a variety of lacquers may be used to give pleasing results.

A detailed view of the magazine rack is shown in this illustration. As you may see, it is provided with racks for different magazines and papers. If it is lacquered and decalcomania transfers applied, a very neat and handy article is the result.

It is well in starting the construction, to lay the piece out to dimensions, saw and smooth all parts to a square form, excepting the edges or ends that have to be shaped or sawed to a curve, which may be left rough and to approximate dimensions. Care must be taken in sawing and planing the edges of plywood, since the grain runs in both directions and a coarse saw or injudicious use of the plane may result in broken or torn wood. The dimensions as given in the material list will serve as a guide at this period of the work. Now lay out cardboard patterns using the ½" squares as indicated in the drawing. Cut these patterns out and mark around them on the wood. If a motor driven band saw and a jig saw are available, for sawing the curves, it would be well to nail the pieces that are made up in

(*Continued on page* 467)



The constructional details of the rack are shown in the above drawings. By dividing the templates used, into small squares, it is easy to cut the parts to any desired shape.

The sizes of the different partitions used in the construction of the rack are also shown in these illustrations. The sizes may be copied exactly, or a different design may be used with slight variations.

MOTOR HINTS

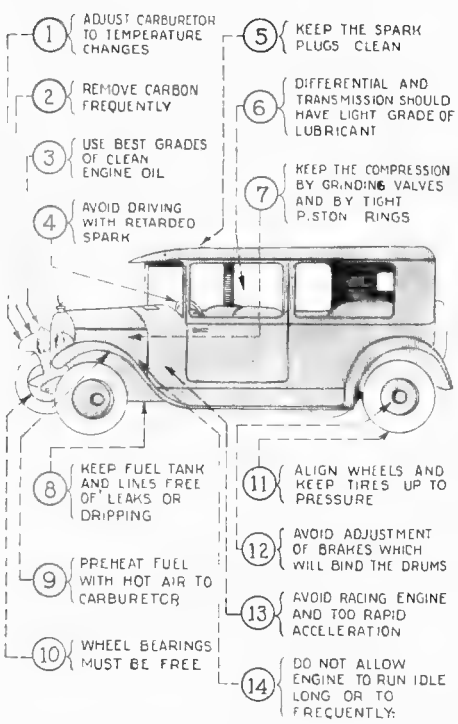
Conducted by GEORGE A. LUERS

FOURTEEN RULES TO INCREASE THE GASOLINE MILEAGE

The charted rules in the attached table are intended as a guide to the driver, in eliminating the factors which contribute to the excessive use of gasoline.

These are self-explanatory in that they point out the factors in car operation and maintenance which can be corrected, adjusted or adhered to in order that the big item of gasoline costs will be reduced to a minimum.

Consistent with these rules, the driver should drive with a consideration toward saving fuel. This should include a speed that does not create high air resistances, an economical speed being about twenty-five miles an hour. Advantage should be taken on long hills to coast, if the grades permit. The engine should not be allowed to run unnecessarily and last, but by no means least, the owner should buy gas at a reputable station, where he is sure of getting full measure.


1 ADJUST CARBURETOR TO TEMPERATURE CHANGES
2 REMOVE CARBON FREQUENTLY
3 USE BEST GRADES OF CLEAN ENGINE OIL
4 AVOID DRIVING WITH RETARDED SPARK
5 KEEP THE SPARK PLUGS CLEAN
6 DIFFERENTIAL AND TRANSMISSION SHOULD HAVE LIGHT GRADE OF LUBRICANT
7 KEEP THE COMPRESSION BY GRINDING VALVES AND BY TIGHT PISTON RINGS
8 KEEP FUEL TANK AND LINES FREE OF LEAKS OR DRIPPING
9 PREHEAT FUEL WITH HOT AIR TO CARBURETOR
10 WHEEL BEARINGS MUST BE FREE
11 ALIGN WHEELS AND KEEP TIRES UP TO PRESSURE
12 AVOID ADJUSTMENT OF BRAKES WHICH WILL BIND THE DRUMS
13 AVOID RACING ENGINE AND TOO RAPID ACCELERATION
14 DO NOT ALLOW ENGINE TO RUN IDLE LONG OR TO FREQUENTLY

The above illustration shows the 14 rules to increase the gasoline mileage of your car.

A SUPPLY OF GASOLINE OR OIL IN PRIVATE GARAGE

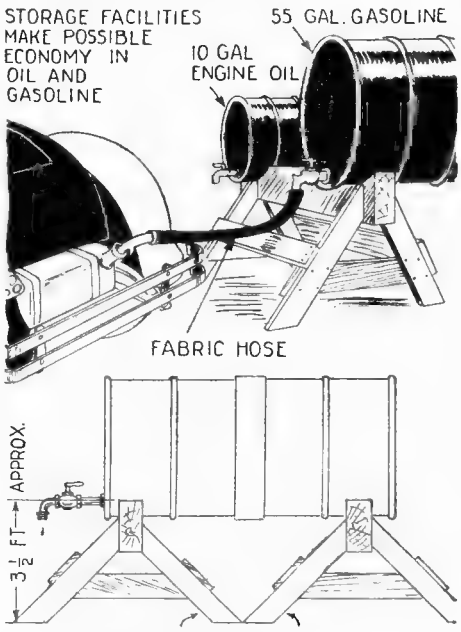
The storage of a fifty-five gallon drum of gasoline and a ten or twenty gallon drum of lubricating oil, is a convenience that the owner cannot well overlook, in view of the saving in costs made possible by buying in quantity.

To overcome all difficulty, the writer is showing in the attached drawing, a simple trestle arrangement, which has been adopted by one ingenious owner.

Two trestles are used, which are placed parallel, to one another, and the drums rest in the notches in these trestles.

Gasoline is gravity fed into the gasoline tank of the car, through a short length of fabric hose.

These drums are periodically refilled from the oil company's tank wagon, without removing them from position.


STORAGE FACILITIES MAKE POSSIBLE ECONOMY IN OIL AND GASOLINE
55 GAL. GASOLINE
10 GAL ENGINE OIL
FABRIC HOSE
APPROX. 3½ FT.
WOODEN SUPPORTS FOR HOLDING THE OIL DRUMS

If your home is not situated near a service station, it will be very handy to have a supply of gasoline in your garage.

Oil is withdrawn into any measure for filling the engine reservoir.

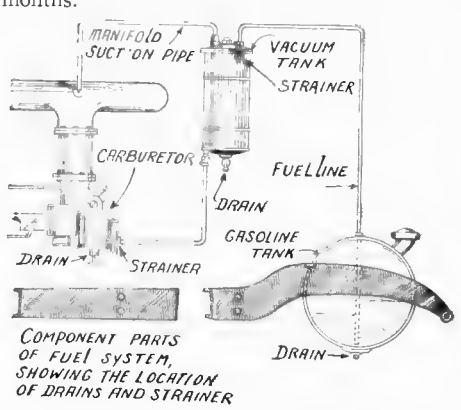
TO PREVENT FAILURE OF THE CAR'S FUEL SYSTEM

The diagram shows the fuel system and the provision the manufacturer has provided for its care. To take care of the system the owner should give it the attention as indicated in the seven rules given below.

(1) Gasoline tank drain should be opened each three months and the sediment should be drawn off.

(2) Gasoline line between the main tank and vacuum reservoir should be disconnected and blown out with compressed air yearly.

(3) Vacuum tank strainer should be removed and cleaned with a brush each six months.



Important parts of auto fuel system.

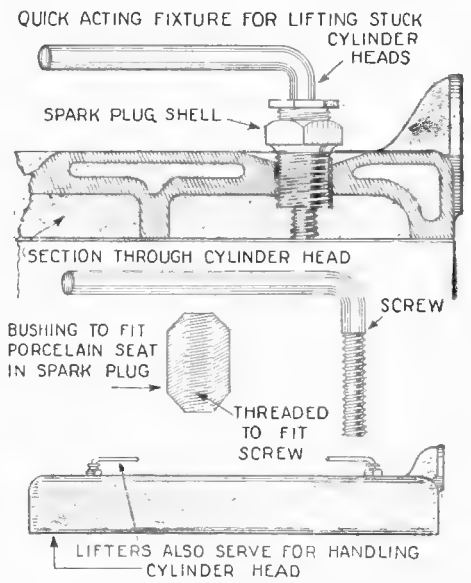
(4) Vacuum tank drain should be opened and about a gill should be withdrawn each month.

(5) The carburetor drain should be opened each month and drained until the gasoline runs clean and free.

(6) Test the manifold suction pipe connections with oil, while the engine is running; bubbles show leaky joints, occasionally tighten the joints. This should be done each six months.

(7) Avoid the use of doped and patent gasolines, which contain alcohol and benzol mixtures, unless approved by the manufacturer of the car. Some of these are particularly corrosive and cause scaling inside the tank.

With the above attention, the motorist will practically eliminate any trouble from the fuel system and also maintain a car that can be relied upon.


QUICK ACTING FIXTURE FOR LIFTING STUCK CYLINDER HEADS
CYLINDER HEADS
SPARK PLUG SHELL
SECTION THROUGH CYLINDER HEAD
SCREW
BUSHING TO FIT PORCELAIN SEAT IN SPARK PLUG
THREADED TO FIT SCREW
LIFTERS ALSO SERVE FOR HANDLING CYLINDER HEAD

When removing cylinder heads, considerable difficulty is sometimes encountered. The above device simplifies this task and also serves as a handle to lift the head to a bench.

QUICK ACTING FIXTURE FOR LIFTING STUCK CYLINDER HEADS

Some mechanics loosen cylinder head bolts one half turn and start the engine to remove cylinder heads. Others use a chisel and drive this under the edges of the head to lift it off. Either method will break and ruin the gasket.

A method which can be used to advantage, is shown in the attached sketch, and with this the cylinder head will invariably lift, without spoiling the gasket and the job can be done quicker than with the above means.

Make two extractors from spark plug shells, placing threaded bushings in place of the porcelains, make two screw handles to fit the bushings.

These tools should be placed on each end of the head, the spark plugs screwed in sufficiently with the fingers to take hold and the handles are then turned, to the point where the lower ends press against the upper surface of the cylinder block and the head is loosened with a couple of turns. These same handles are of service to lift the head over to a bench.

The Radio Séance

By **KARYL KANET**

In Which the Radio Voice from the Spirit World is Not All that it Seems

"RIGHT this way, professor," said Madame Lulu, showing the way into her séance chamber.

"Er—ah—yes, certainly," brightly remarked Professor Littleton.

The professor, a typical Englishman, was the last of the Society for the Study of the Occult to arrive at the home of Madame Lulu—accent on the last syllable; French, you know—the well-known Radio Medium. The four other members of the committee chosen by the S. S. O. to investigate Madame Lulu's claims to a close kinship with the other world were already seated in the black-painted wooden chairs in the black-hung room.

There were Herlock Coyle, famous author and devout believer in fairies; Dr. Willard Jeemes, instructor in metaphysics at Haleton College; the grey-haired Alfred Jimpson, millionaire, delver into magic and retired gum-drop manufacturer; and Thurston Howdidhe, unrivalled magician and discloser of fake mediums. ⟶

For the past year Madame Lulu had been doing very well, very well indeed. People had come from far and near to her wonderful séances.

You don't know who she is? Oh, don't you read the papers? Surely you couldn't have missed seeing her advertisements, printed once a week in the leading newspapers of the big city in which she lived.

Yes, Madame Lulu had done very well by herself. Lately she had to have a secretary to arrange the séances for her, and with the proceeds she had moved into a new house, all fitted up especially for the high purpose of giving radio séances.

Madame Lulu herself had blossomed forth into a permanent wave for her genteel grey hair, manicure for her stubby fingers, and very impressive justly black taffeta dresses for her buxom figure.

All had gone merrily, and many five dollar fees had rolled in, until the Society for the Study of the Occult, having heard wonderful reports of the madam's prowess, decided to investigate.

The Society was composed mostly of elderly gentlemen, well endowed with this world's goods, who believed in ghosts and spent their time in trying to find a real, honest-to-goodness medium. They were unsuccessful because, unfortunately, to the Society also belonged some skeptics, whose minds were open to conviction but who had so far failed to be convinced. The chief skeptic was Thurston Howdidhe, the world-famous magician, who always managed to expose the methods of each new medium as trickery.

Madame Lulu was very much excited. Ah, if only she could convince the Society, the grand sum of $100,000 which the Society had announced it would award to an honest medium, for further research, was hers! Everything was ready. All her preparations were complete. She even did the committee the honor of ushering them into the house herself.

Coyle, the chairman and spokesman of the committee, rose.

"Ah, professor, now that you are here we shall proceed about our business," he orated in a pompous, weighty voice. Coyle liked to believe in the airy, slender fairies, dancing lightly in the moonlight on the green.

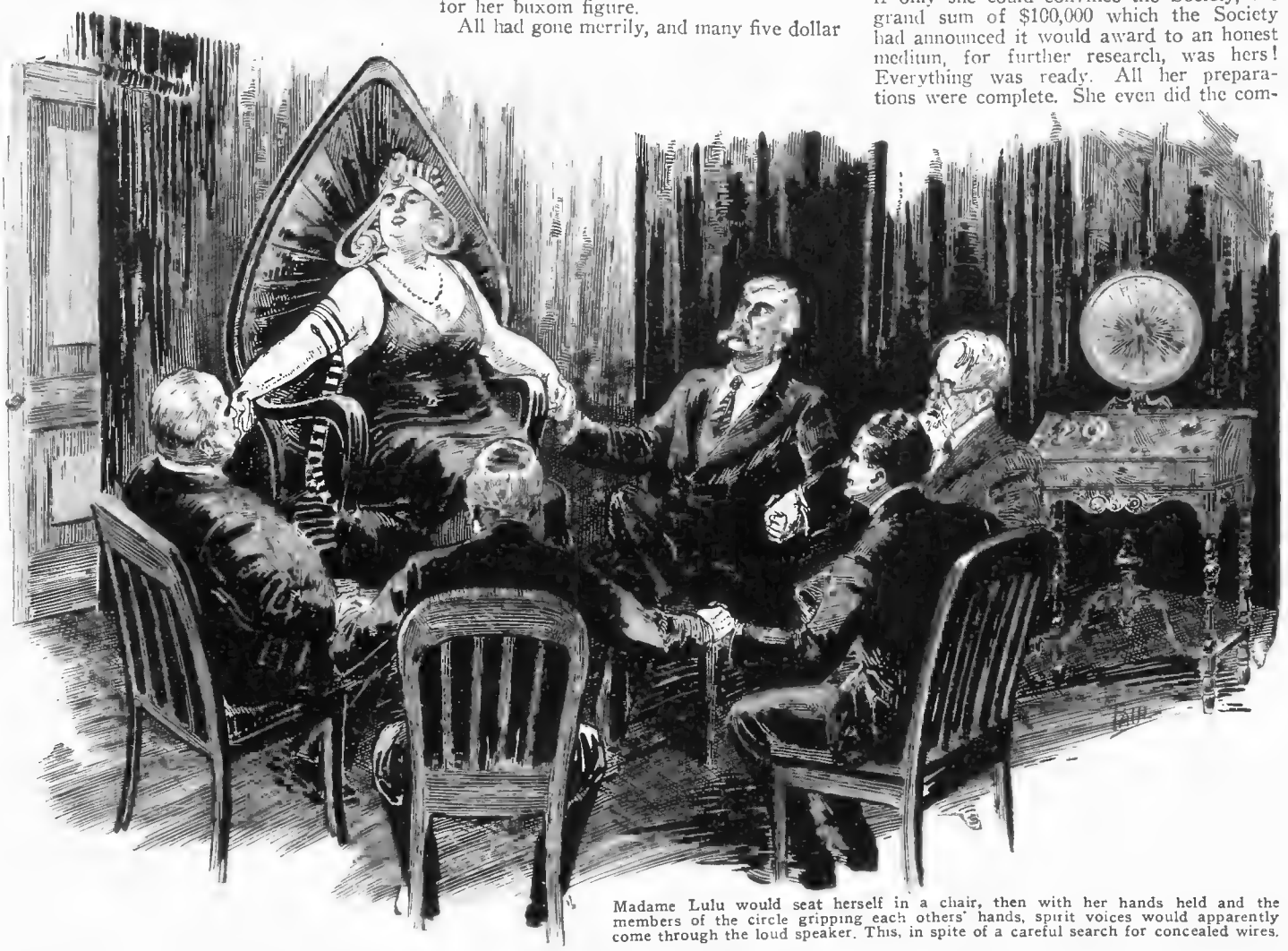
He turned to the madame. "Madame Lulu, I am speaking for the Society for the Study of the Occult. We are here to-night to test you, to see if you really are all you represent yourself to be." Here he looked at the other members for approval.

"We have heard, my dear madame," he continued, "that you achieve connection with the spirit world through the medium of that wonderful invention, the radio."

"We have heard wonderful reports of you. We have heard——" the voice of Professor Littleton broke in eagerly.

Coyle's voice, never pausing, rose higher

(*Continued on page* 453)



Madame Lulu would seat herself in a chair, then with her hands held and the members of the circle gripping each others' hands, spirit voices would apparently come through the loud speaker. This, in spite of a careful search for concealed wires.

SPEAK TO THE SPIRITS OF YOUR LOVED ONES BY RADIO!!!

Let

MADAME LULU,

noted MEDIUM and translator of spirit messages,

TRANSMIT TO YOU MESSAGES OF HOPE

from

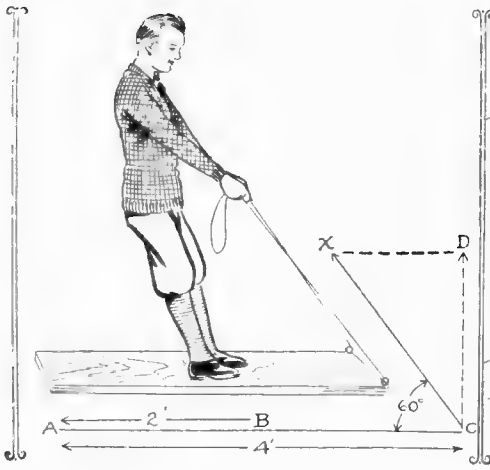
! ! THE OTHER WORLD ! !

Private séances $2 and $5

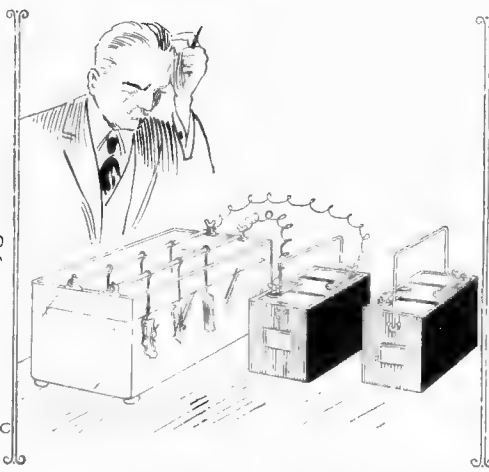
Scientific Problems and Puzzles

Try to Solve the Problems Below and Test Your Knowledge of General Science

By ERNEST K. CHAPIN

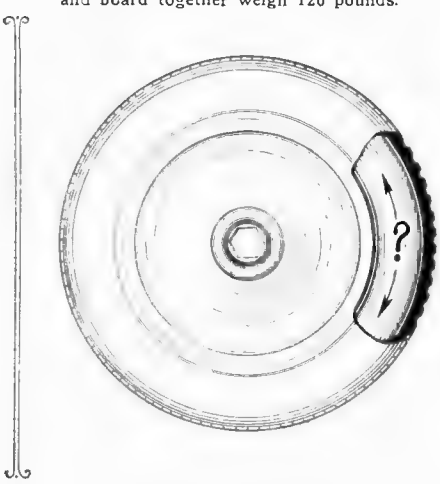


Is it possible for a boy to raise himself in this manner, and if so, what force would be required? AC is a board 4 feet long. A boy stands at the mid-point B and pulls at a rope attached at C. The rope makes an angle of sixty degrees with the horizontal. The boy and board together weigh 120 pounds.

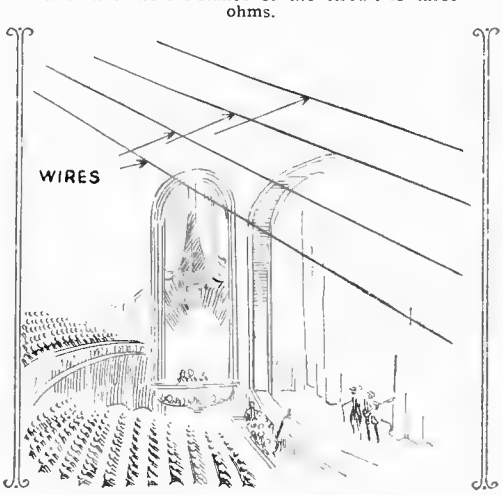


A man has two 100 ampere-hour storage batteries to use in operating a plating bath. How should he use the batteries to get the maximum amount of plating? Should he use them one at a time, or connect them in series? Assume that the batteries test six volts each, and that the resistance of the circuit is three ohms.

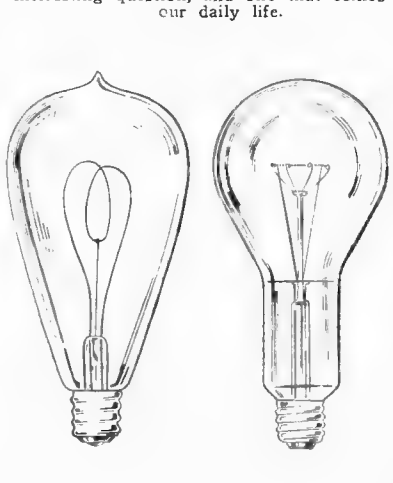
Sometimes when using the water in the sink, you turn the faucet so that the water runs quietly. When the water is running this way, is the cross-section of the stream of water uniform throughout its length? What reasons do you give for your answer. This is a very interesting question, and one that comes into our daily life.



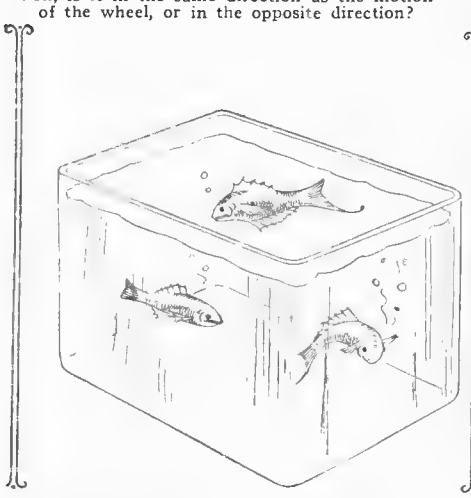
Have you ever considered the question of the air in your tires? When your automobile is in motion, does the air circulate within the tires, or does it move at exactly the same rate of speed as the wheels? If there is circulation, is it in the same direction as the motion of the wheel, or in the opposite direction?



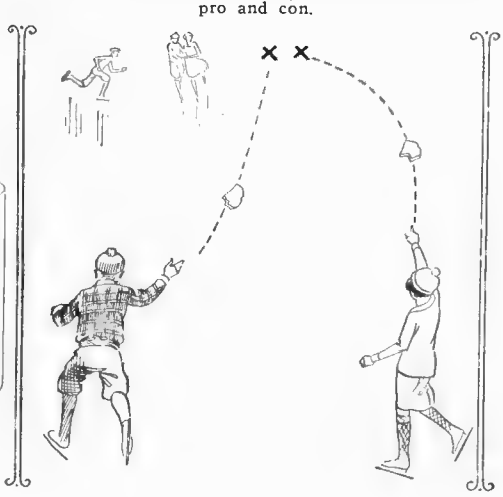
Very often you will notice in auditoriums and theatres that there are wires strung across the ceiling to prevent echoes and to reduce reverberation. Are wires of this type effective in reducing the echo? Before reading the answer on page 447, think carefully of all the reasons pro and con.



A 120 watt carbon filament lamp and a 100 watt gas-filled tungsten filament lamp are about the same in size. As you have probably noticed, the 100 watt lamp not only emits more light, but the bulb gets hotter. It appears to give out more heat, also, although using less power. Can you explain this?

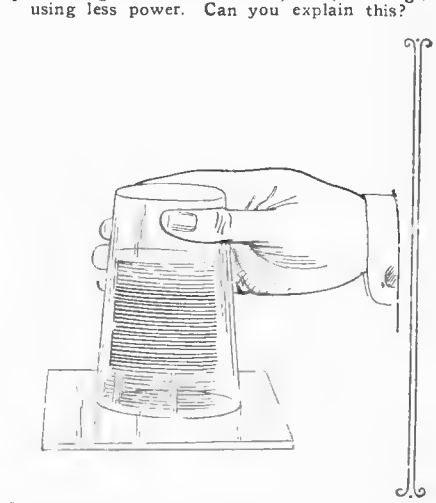


The ancient philosophers used to wrangle over the following problem: A fish cannot move forward, they said, until the water in front of him has moved to one side. But the water will not move to one side, until the fish has moved forward. How, then, can he move? Can you solve the difficulty?



Here is a problem that you can solve next winter when you are skating. The two pieces of ice have been thrown, one along the surface of the ice and the other one through the air. Is it possible to skid a piece of ice farther along a smooth surface of a frozen pond, than to throw it through the air?

(Answers to these problems appear on page 447.)



Fill a tumbler nearly full of water and cover the top with a glass plate. Now invert the tumbler and the glass plate will remain over the mouth of the tumbler and sustain the pressure of the air in the tumbler, and the weight of the water. Is the air pressure in the tumbler less than before it was inverted?

MAGIC By "DUNNINGER"

HIPPODROME Tonight
DUNNINGER
DARE DEVIL FEAT TEMPEST
DUNNINGER AMAZES TRIBUNE EMPLOYEES IN DEMONSTRATION
Joe Dunninger Tells How Prince Got Trick to Show Home Folks
DUNNINGER
HYPNOTIST RULES SUBJECT BY RADIO
Reads Mayor's Inner Mind

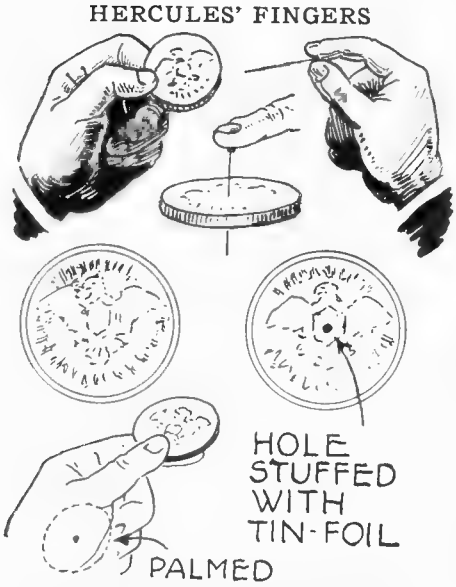
THE MAN WHO MYSTIFIED

Pres. Coolidge
Prince of Wales, Ex-President Harding, Taft, Roosevelt, and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION

Folks Are Mystified Yet Delighted by This Man!
DUNNINGER ASTONISHES COMMITTEE IN LIBRARY TEST OF MIND READING
Mind You! The Mind Reader Really Read the Mayor's Mind
DUNNINGER DRAWS MORE BIG CROWDS
Dunninger Will Attempt To Hypnotize Patient, 10 Miles Away, by Radio

NO. 54 OF A SERIES

HERCULES' FINGERS

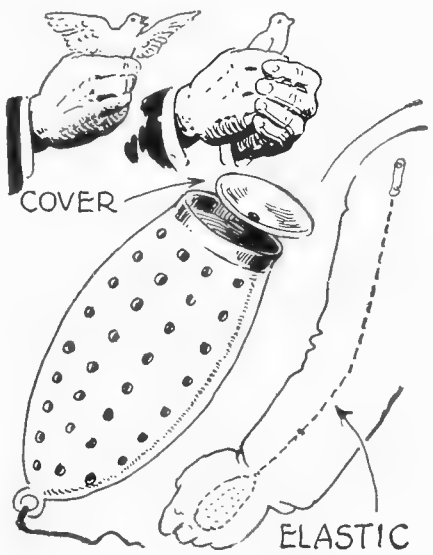


An unprepared coin is passed for examination. When it is returned to the wizard he takes an ordinary pin and pushes it through the center of the coin. On removing the pin, the coin is again passed out. A second coin helps in the deception.

THE wizard passes an unprepared common steel pin together with a silver half dollar for minute inspection. Both are returned to him, having been found intact. The magician then explains that he has the most remarkable and uncanny amount of strength in his fingers and after centering the pin, he pushes it clear through the coin. Grasping both ends of the pin, he then twists the coin making it spin about its steel center. Two coins are necessary for the trick; one has a small hole drilled through the center and stuffed with tinfoil. This is palmed while the duplicate whole coin is passed for examination. The transfer is made while the spectators are examining the pin.

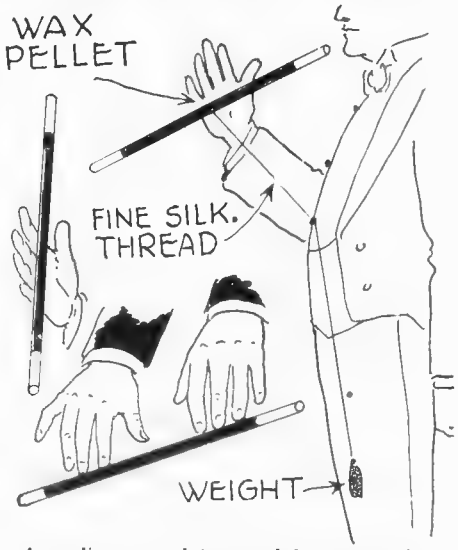
THE VANISHING BIRD

TRICKS with livestock are always a favorite with the average audience. In this novel creation the wizard holds a small fluttering bird between his fingers. Gently placing his hands around it so as to completely cover the bird, his palms are brought gradually together. The fingers are opened a moment, one at a time, when much to the amazement of the audience the bird has completely vanished. The canary finds its way safely into the mouth of a small metal feke, which is drawn up into the magician's sleeve by the usual elastic arrangement. A pivoted cap prevents the bird's escape, while holes in the metal case allow the bird to breathe freely.



By the aid of the feke illustrated in the diagram above, a bird can be made to vanish from the hand.

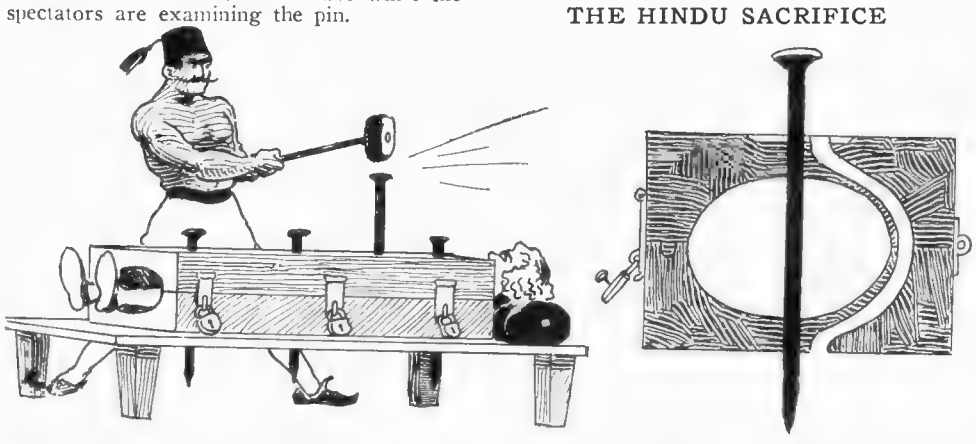
THE MAGNETIZED WAND



An ordinary wand is passed for examination. On its return it can be made to mysteriously adhere to the fingertips or to the palm. A piece of wax, a thread, and a weight are required to produce this trick. Notice the weight in the trouser leg.

IN this unique experiment the conjurer, after passing his wand for examination, causes it to adhere to the fingertips, to the palm or back of the hand in a series of mysterious positions. At any moment he can pass the wand for examination, get it back and repeat the effect. The slightest clue as to the reason cannot be detected. For the effect, the magician's friends, a fine silk thread, and a pellet of wax are responsible. The thread leads down through the magician's shirt front into the leg of his trousers where a small weight is affixed. The weight holds the thread under constant tension, yet it is possible to move the wand away from or toward the body without releasing the apparent magnetic attraction.

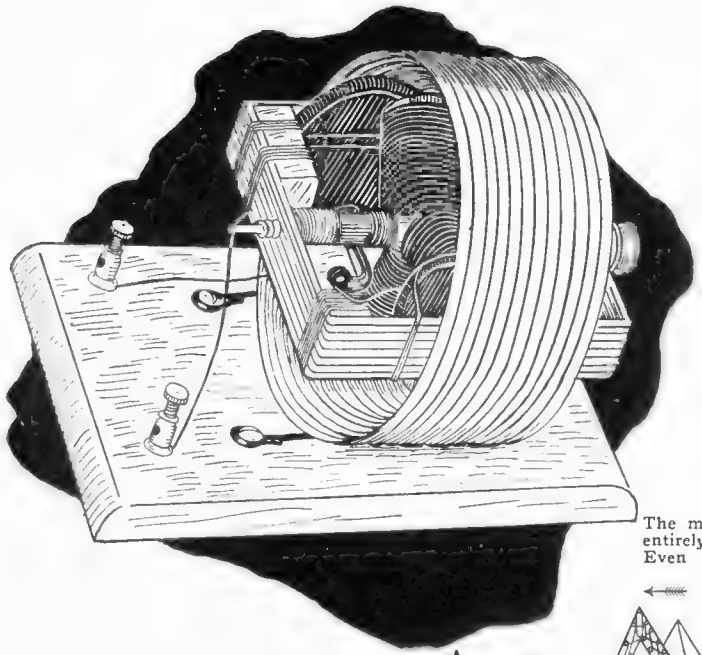
THE HINDU SACRIFICE



In this novel illusion several attendants drive a number of spikes through a casket which is just large enough to hold a young lady. She watches the procedure with evident interest. The casket is turned in such a way that the audience can observe the spikes being actually driven through the box. They are removed with the aid of a crow-bar. The box is opened, the girl steps in and is hypnotized, whereupon the box is locked. The spikes now are again driven through the box. The deception is perfect. In reality, however, the nails pass through a steel tubular guide which circles around the body of the hypnotized maiden. The spikes may be made of lead or any other flexible alloy or might even be made of brass or steel.

$3,000.00

Motor Wins First Prize—$100.00

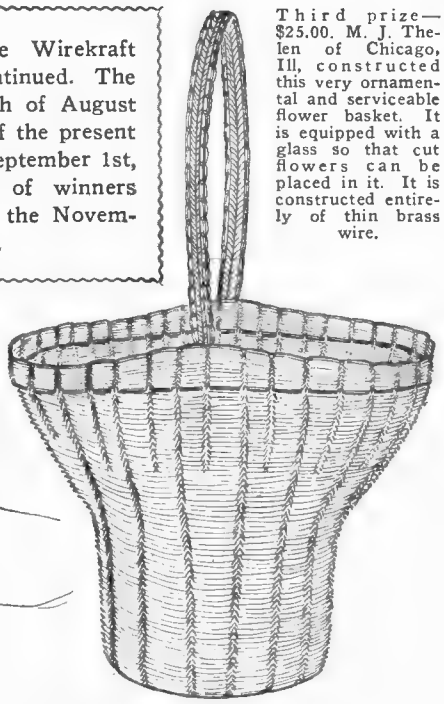


First prize—$100.00. Carl Von Bargen of Alliance, Neb., constructed the motor shown in the above illustration. It is a three pole motor, series wound. It runs on a six volt battery and consumes three amperes of current.

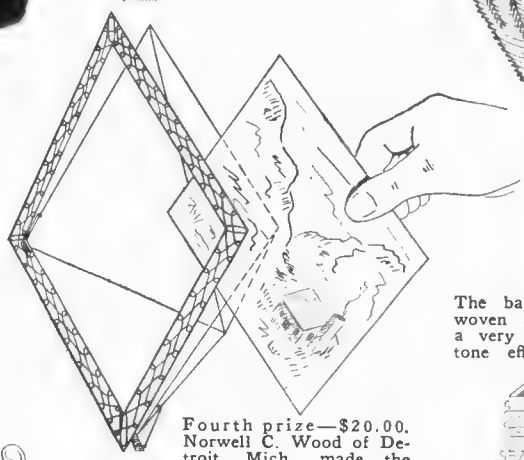
The motor shown at the left is entirely constructed of wire. Even the commutator is made of wire segments.

With this issue the Wirekraft Contest is to be discontinued. The contest for the month of August thus makes the last of the present series. This closes September 1st, and the last group of winners will be announced in the November issue.

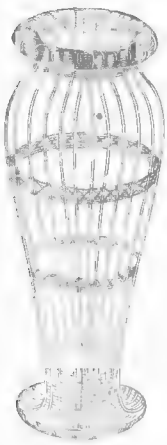
Third prize—$25.00. M. J. Thelen of Chicago, Ill, constructed this very ornamental and serviceable flower basket. It is equipped with a glass so that cut flowers can be placed in it. It is constructed entirely of thin brass wire.



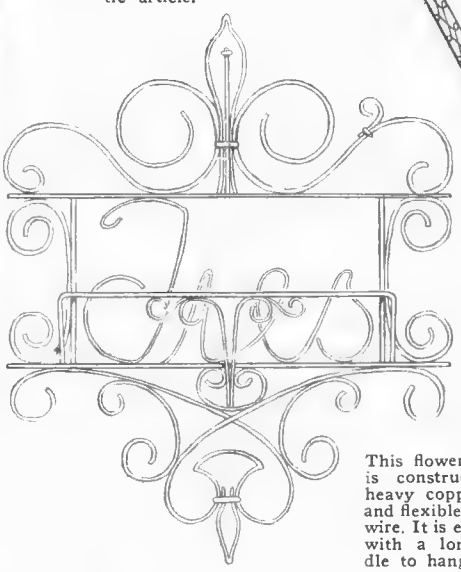
The basket shown above was very neatly woven and in its completed form presents a very strong but light object. In a two tone effect, it becomes highly ornamental.



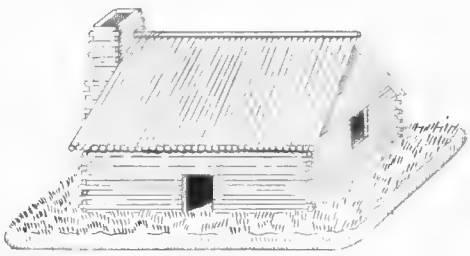
Fourth prize—$20.00. Norwell C. Wood of Detroit, Mich., made the picture frame shown above. It is arranged so that the picture may be easily removed.



Second prize—$50.00. Awarded to Henry Heft of Cincinnati, O. It is constructed of heavy iron wire and has a bowl in the bottom to catch water from the wet umbrellas. This is a very serviceable and artistic article.



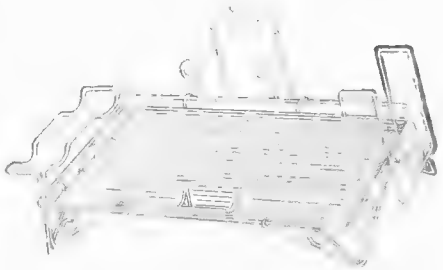
Tenth prize—$2.00 The tie rack shown on the right was made by James F. Wickliffe of Greenville, S. C. It is constructed of heavy iron wire bronzed to give it an old effect. It is equipped with a rack and will hold quite a number of ties.



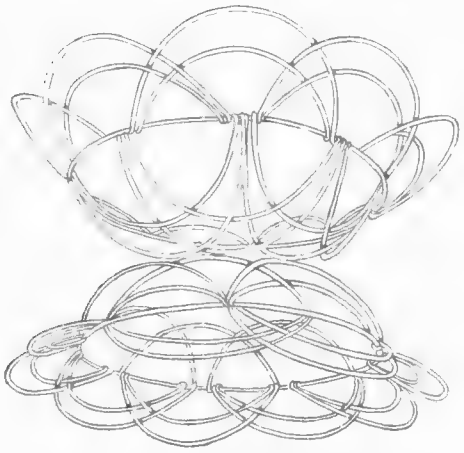
Twelfth prize—$2.00. The incense burner shown above was constructed by George B. Hastetter of Freewater, Ore.

This flower basket is constructed of heavy copper wire and flexible picture wire. It is equipped with a long handle to hang it by.

Eleventh prize—$2.00 was awarded to Peter J. Nicholas of Foxcroft, Me.

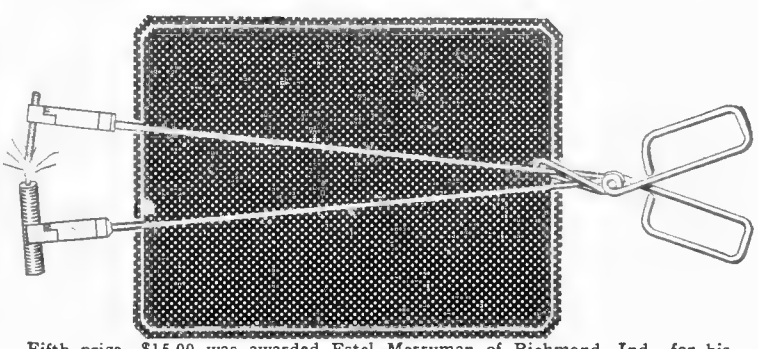


Eighth prize—$5.00. This ash tray is made of copper wire and is arranged to hold a cigarette package and matches. Contributor please forward address.



Sixth prize—$10.00. The basket arrangement shown above was awarded the sixth prize in this issue. Contributor please forward address.

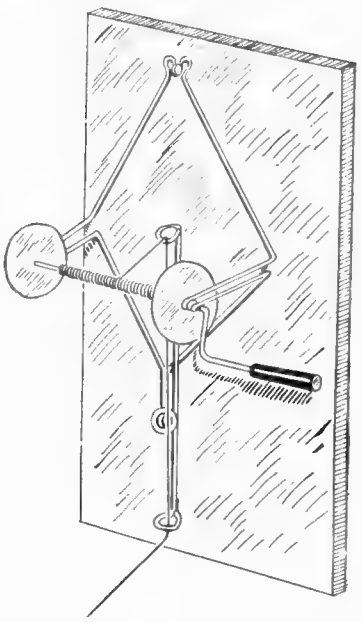
Sixteenth prize—$2.00 was awarded to Louis B. Sklar, Philadelphia, Pa.



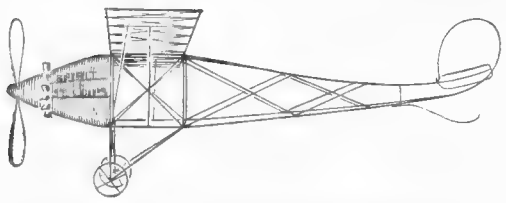
Fifth prize—$15.00 was awarded Estel Merryman of Richmond, Ind., for his firecracker holder. This article makes Fourth of July celebrating safe.

Wirekraft Contest

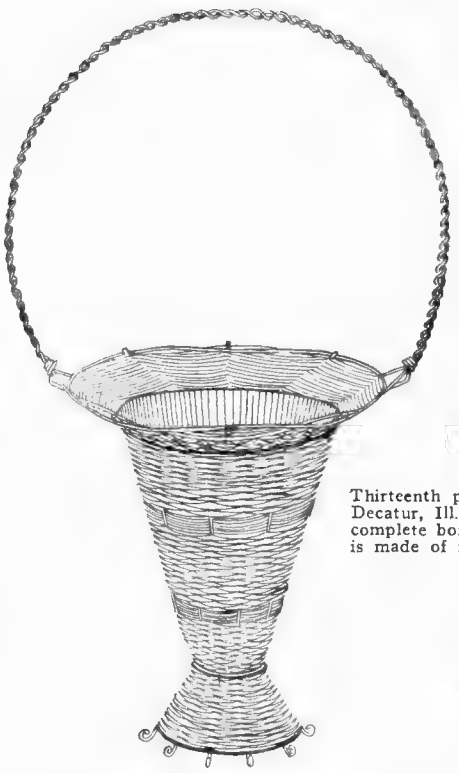
Umbrella Stand Wins Second Award—$50.00



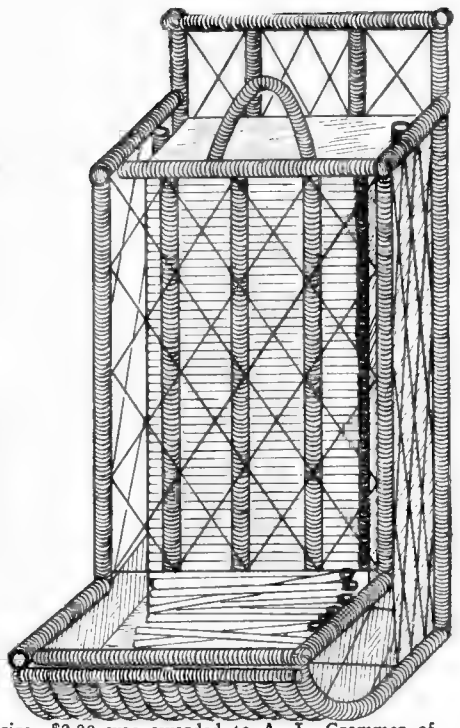
Seventh prize—$7.50 was awarded to C. P. Petrini, Jr., of Chicago, Ill. It is a handy string saving device to be hung on the wall or back of the door. Pieces of string from packages are tied end to end and wound on the reed.



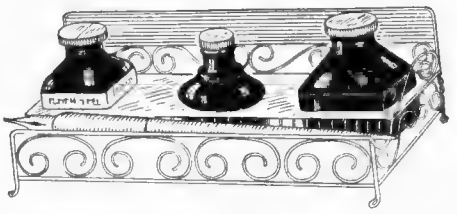
Fifteenth prize—$2.00 was awarded to V. O. Hathorn, of Portland, Ore., for the airplane shown below.



Ninth prize—$3.50. The basket shown above was constructed by Harold Jackson, of Kankakee, Ill.



Thirteenth prize—$2.00 was awarded to A. L. Grammer of Decatur, Ill., for his safety matchbox holder. It will hold a complete box of strike anywhere safety matches. The model is made of iron wire, painted to give it a neat appearance.



Fourteenth prize—$2.00. E. F. Storz of Detroit, Mich, made the handy ink stand shown above. It will hold three ink bottles and several pens.

RULES OF WIREKRAFT CONTEST

THIS is a wirekraft contest. Hence wire is to be used in the construction of all of the models entered in this contest.

The size of the wire to be employed is limited. The heaviest wire must not be larger than No. 8 American or B and S gauge, and the smallest no smaller than No. 30 B and S gauge—or (for foreign countries not having these exact sizes), the nearest available equivalent.

No. 8 B and S gauge is .12849 inches in diameter or 3.264 millimeters. Its nearest equivalent in the Birmingham or Stubs iron wire gauge is No. 18. In the Stubs steel wire gauge it is No. 30; in the British Imperial Standard it is No. 10. The nearest wire to No. 30 B and S gauge which is .01002 inches or .2546 millimeters in diameter is No. 31 in the Birmingham or Stubs iron wire gauge. In the Stubs steel wire gauge it is No. 80; in the British Standard it is No. 33.

The builder may avail himself of the opportunity of using any intermediate sizes of wires between No. 8 and No. 30, B and S gauge.

The wire may be copper, brass, iron, steel, or these materials coppered, tinned, nickel-plated, or galvanized, or the wire may consist of an alloy. Any kind of wire available on the market may be employed.

It is preferable to use non-rusting wires. The publishers will not be responsible for the rusting of any model. To protect wire which rusts easily or for color effects, the models may be painted, lacquered, varnished or otherwise covered.

Any additional decorations or accessories may be employed to enhance the effect. (Example: Silk on a lamp shade; glass in decorative fixtures; electric motors for operating mechanisms, etc.)

Only those portions actually constructed of wire will be judged.

(Example: A reed basket is suspended from a wire chain. The basket not being made of wire is NOT considered. On the merits of the chain only will the prize be awarded.)

Wires may be twisted, spliced, soldered, welded or bound together. Wire may be used to bind other wires together. If soldered a non-corrosive soldering flux should be employed.

There is no limit to the size of the models which may be entered nor to the number of entries which any maker may submit during any calendar month.

In every case the model must be forwarded express prepaid to SCIENCE AND INVENTION Magazine. It should be tagged with name and address of the maker, who will prepay charges if model is to be returned.

The first prize will always be awarded to a model possessing the greatest utilitarian merits. This must be an object NOT found on the market today.

The second prize will always be awarded to an object possessing the best decorative, artistic or constructive effect. It may be a replica of an existing object or a model of an imaginative object or effect.

The remaining prizes will be judged from either one or the other viewpoints at the discretion of the judges.

All models may remain at the office of this publication until the close of the contest at the discretion of the editors.

Due to popular request the Wirekraft Contest will be discontinued with this issue. All models must be in our hands before the 1st of September to be entered in the August contest. So if you are desirous of winning an award, rush your model to the Wirekraft Editor. Winners for August will be announced in the November issue.

$3,000.00 In Prizes

Arranged in Monthly Awards

First Prize	$100.00
For Utility Only	
Second Prize	50.00
For Artistic, Decorative or Constructive Effect—may be a replica or model of some imaginative or existing object.	
Third Prize	25.00
Fourth Prize	20.00
Fifth Prize	15.00
Sixth Prize	10.00
Seventh Prize	7.50
Eighth Prize	5.00
Ninth Prize	3.50
10th to 16th Prizes of $2.00 each	14.00
Total	$250.00

Tools Required

THE tools required for the construction of Wirekraft articles are described in the Dec. issue of this publication, a reprint of which will be sent free upon request. The following tools may be used advantageously:

1 pair flat-nosed pliers, 1 pair round-nosed pliers, 1 wire cutter, 1 hacksaw, 1 small vise, 1 soldering iron.

The materials which are necessary are:

Solder, soldering paste or flux, nails, one piece of wood, and most important of all, wire of the sizes specified in the contest rules and regulations.

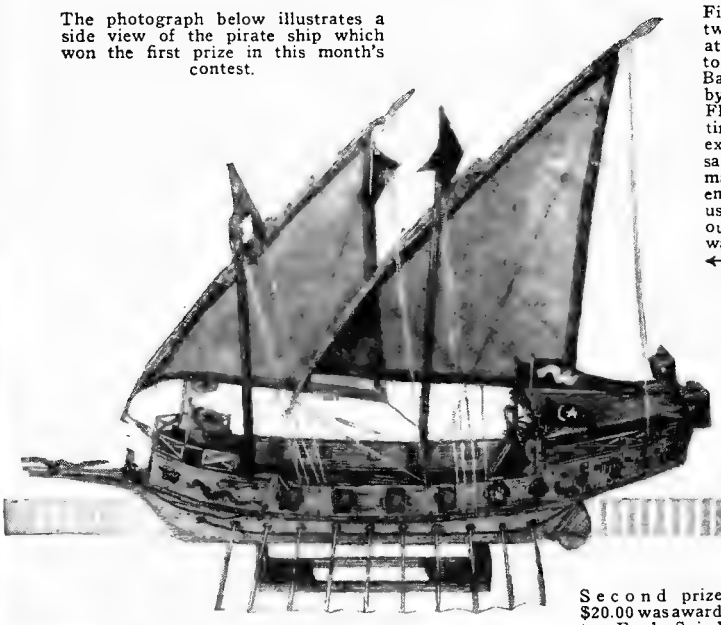
If the builder decides to weld his wires together, a small welding transformer or a storage battery may be used for this purpose. For the formation of long cylinders, a coil winding machine or a lathe may be advantageously employed. Toy motors for the operation of any devices constructed of wire could of course be procured and added to the model and the addition of miniature sockets and bulbs to illuminate the interior of any buildings constructed of wire might also find a place in some of the constructions.

Address all entries to Wirekraft Editor

SCIENCE & INVENTION MAGAZINE
230 Fifth Avenue, New York City

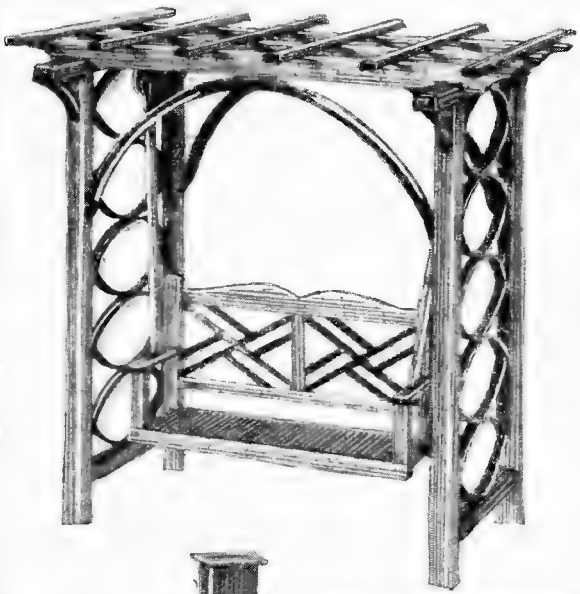
Matchcraft $100.00 Awarded Monthly

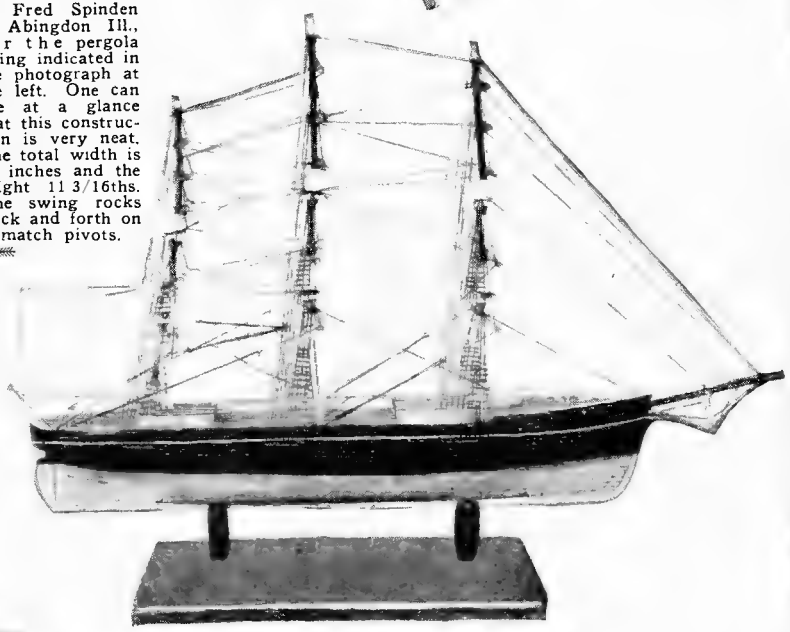
The photograph below illustrates a side view of the pirate ship which won the first prize in this month's contest.



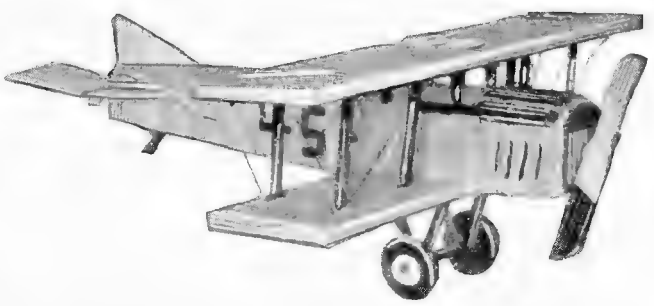
First prize—$50.00. The two photographs, the one at the left and the one to the right show the Barbary Pirate Ship made by Frank Cargill of Flushing, N. Y. The entire vessel, with the exception of the ropes, sails, and flags, is of matches and the sides are engraved by the skillful use of a wood-burning outfit while a fret saw was used to make the railings.

Second prize—$20.00 was awarded to Fred Spinden of Abingdon Ill., for the pergola swing indicated in the photograph at the left. One can see at a glance that this construction is very neat. The total width is 11 inches and the height 11 3/16ths. The swing rocks back and forth on match pivots.





Third prize—$15.00. Here is a replica of a full rigged ship in which the hollow hull of the vessel is made of matches as are the masts, yard arms and bowsprit. The ship is 12½ inches high and 20 inches long. George T. Campbell of Jackson Heights, L. I. built this ship.

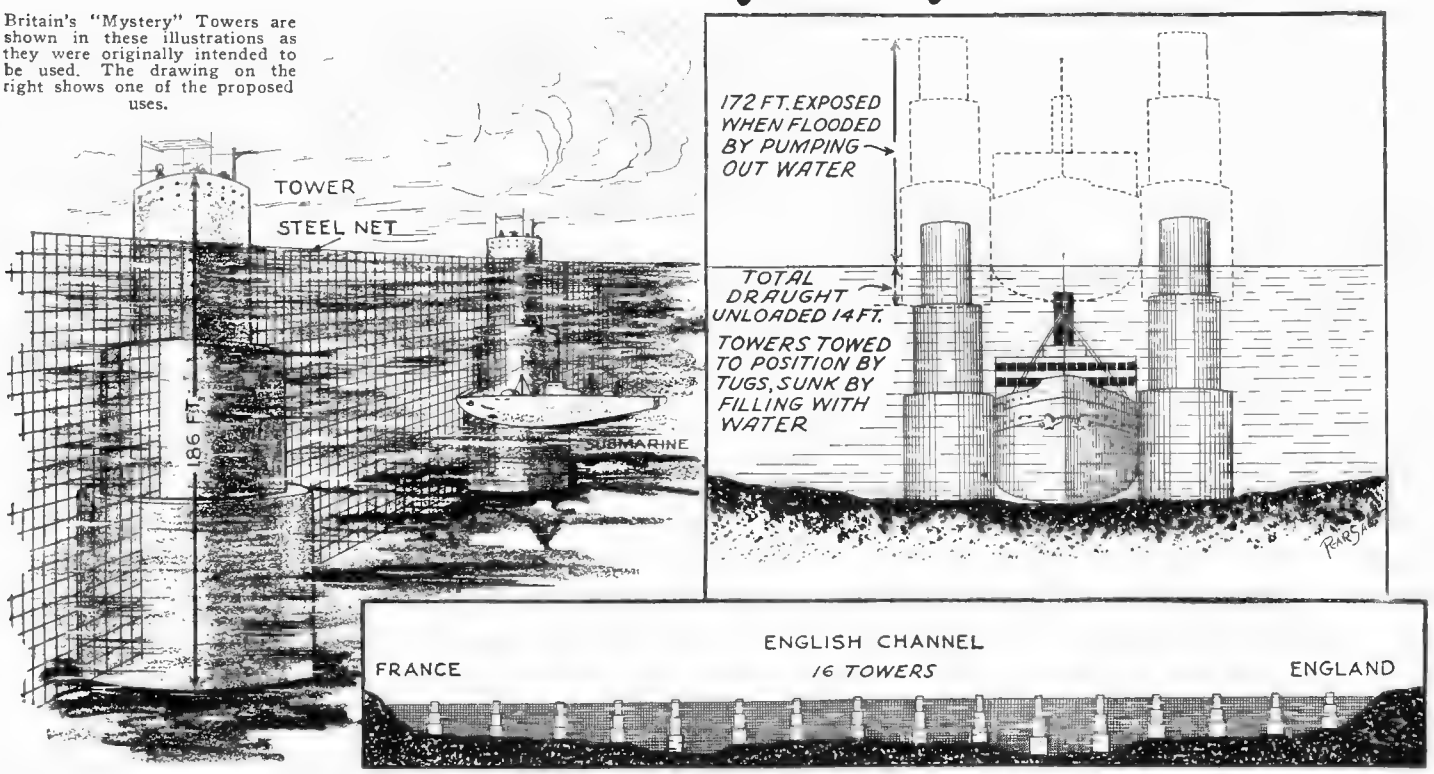


Fourth prize—$10.00. The model house illustrated at left won the fourth prize. This house is completely equipped and furnished with chairs, lamps, tables, beds, and all other furniture. Inasmuch as the house itself is scarcely more than 15 inches long, the production is unique. Builder send name. The airplane illustrated above, built by William Wellner of Bridgeport, Conn., won the fifth prize of $5.00.

Note: The October issue will contain the last group of awards in the Matchcraft Contest.

New Use for "Mystery" Towers

Britain's "Mystery" Towers are shown in these illustrations as they were originally intended to be used. The drawing on the right shows one of the proposed uses.



During the war, England started to build a series of towers, constructed of hollow concrete blocks arranged so that they could be filled with water, concrete or air. They were 186 feet high, and when floated took a draught of 14 feet. The program of construction called for 16 of these towers, which were to be sunk at intervals across the English channel, linked by strong steel nets to prevent German submarines from entering the channel. Two of these towers had been constructed at the time of the Armistice. One of these was recently destroyed, and the other one has been placed off Spithead where it is doing duty as a lighthouse. At the close of the war an ingenious idea was suggested for using the two towers constructed. It was believed that they could be used for salvaging ships sunk by submarines. The towers would be towed to the scene of the wreck, then sunk and securely fastened to the ship. Then they were to be pumped full of air and towed back to the shore. This idea was never carried out, but the principle involved is thoroughly sound. The method of raising sunken ships sunken ships by attaching pontoons, made buoyant by blowing out the water with compressed air, has been proven eminently practical.

The Astrology Humbug

By JOSEPH H. KRAUS

Further Letters From Our Readers and Our Answers

HAS BEEN FOOLED

Editor, SCIENCE AND INVENTION:

I take great pleasure in reading your articles on astrology. To my thinking, this humbug has no place in a civilized world or rather in a country. It belongs to the dark ages, where no doubt, they could have found someone to believe it.

Personally, I have written to several of them for my horoscope and all of them told me I was a born leader of men. Well I've never led any so far or experienced any of the other luxuries they promised me. One in particular I remember writing to, told me that I would meet with a serious accident within two months (this was three years ago) and the nearest I came to accidents is looking at them in the horoscopes. Two or three weeks later I wrote to this same astrologer again for a reading about my future career and received my letter back with this inscription on the back, "Professor Bolles has passed away. We regret that you can't have an extensive reading." But each month I still see Prof. Bolles advertising in the classified advertising section of Popular Mechanics Magazine.

It looks rather dark for astrologers, because if there was any truth in it they would try for your reward instead of arguing about it. Of all their arguments I have not read one that was sound in principle or that didn't have a lot of red tape to it.

ELMER C. LA LONE,
Norfolk, N. Y.

(We find it more and more difficult to comment on astrological letters as the months roll along. The astrologers attack us claiming that we are entirely too bitter in our comments. The readers who do not believe in astrology chide us for being too lenient. It is difficult, therefore, to express any opinion on a communication without having one or the other faction call us down for the way in which we have commented upon the communication.

We make this next statement without any bitterness toward the astrologers whatever. Most astrologers do not claim that the effect of the planets is so powerful that predictions must come true. They abide by the now nearly time-worn phrase, "The stars impel but cannot compel."

A typical example of the fallacy of an astrologer's prediction was demonstrated in New York recently when Prof. Gustave Meyer, who at one time produced an astrological record for SCIENCE AND INVENTION Magazine, predicted that rain must follow on the Fourth of July because the moon would be under the evil influence of the planet, Saturn. On the other hand, the Weather Bureau predicted clear weather. This is another example of scientific prediction versus the unscientific. The facts were, that in New York City, for which both predictions were made, the Fourth of July presented very clear weather. Again of course the stars impelled, but did not compel. This time their efforts were wasted on the weather and not on an individual.

And yet some of our readers argue that Gustave Meyer is not even an astrologer. Why? Because his predictions are not always fulfilled to the letter? If that is the reason, then the same applies to every astrologer in these United States. Prof. Meyer has had more publicity and perhaps has done more work than four or five average astrologers put together.—EDITOR.)

$6,000.00
For Proofs of Astrology

SCIENCE AND INVENTION Magazine holds that there is nothing scientific in Astrology, that Astrology is not a science and that statements made by astrologers unless very general cannot be entertained seriously.

Accordingly, this publication has decided to award an Astrology Prize for $6,000 for the following:

$5,000 will be paid to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same. He must describe in advance each event in detail, giving the location and result or the casualties if the event is an accident.

$1,000 will be paid to the astrologer or forecaster who will produce three accurate, detailed and perfect horoscopes, free of contradictions on the lives of three people whose initials will be given him when he requests the same and the birth dates and place of birth will also be supplied by this office.

This contest closes October 1st, 1927, and all entries must reach us by that time. In event of a tie, prizes of an identical nature will be given those so tying.

Address all entries to Editor, Astrology, care of SCIENCE AND INVENTION Magazine, 230 Fifth Avenue, New York, N. Y.

QUESTION FROM A STUDENT

Editor, SCIENCE AND INVENTION:

I noticed the Student-Adept of Chicago questions your responsibility to pay the $6,000 which you have offered to astrologers who will take a person furnished by you and make three predictions that will come true.

But as they seem to read your paper I wish to ask a question through you. This will not bar Eyangeline Adams, self-anointed Chief Astrologer of the United States who spouts through the Pictorial Review—nor Wm. Gornold, nicknamed Sepharial of London, self-anointed Chief Astrologer of Europe who spouts through the British Astrologers Journal.

Question. Why do the instructions for making horoscopes say to take the sidereal time of the day of your birth—subtract the number of hours you were born before noon from this time—adding 24 hours if necessary or adding the number of hours you were born after noon to this Sidereal Time of your birth day—to get the true Sidereal Time to use in connection with a Table of Houses —to place the Zodiac signs in the Chart?

Why I ask it. The Sidereal Time for a day is 4 minutes or less and how can you substract 6 hours from it? Suppose you were born at 6 a. m. before the standard time zones were set up by Congress and that on July first when Sidereal Time was 6 h 35 m 8s and you subtract 6 hours and you are on April first S T 0-36-21 using a 1926 ephemeris for illustration.

(*Continued on page* 446)

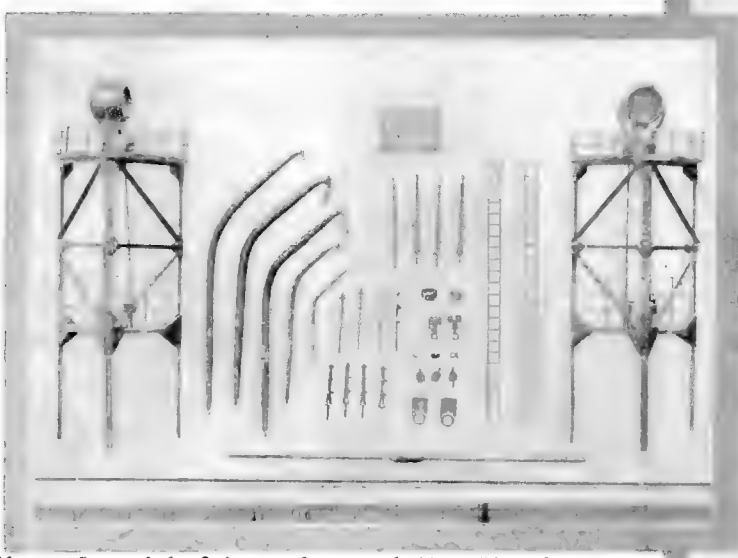
Ships That Never Sail

U. S. Navy Uses Ship Models as Maritime Historians.

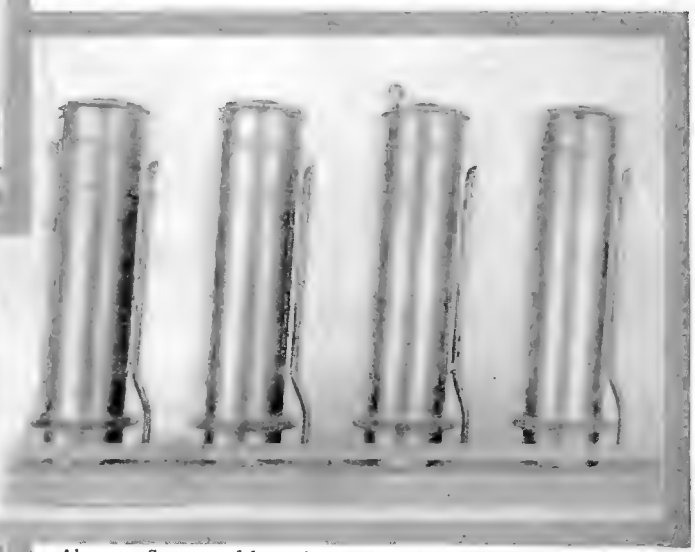
By G. H. DACY

Above is a photograph of a model of the V-1, a U. S. submarine, which was built in the model plant of the Washington Navy Yard. Everything on the model is built to scale.

A model of the three-masted battleship, Vermont, a sister ship of the Constitution, having three gun decks and an armament of 105 large guns. It is equipped with two complete sets of rigging, the running and the standard permanent rigging.



Above: Some of the fittings used on model ships. These fittings are on the scale of ¾ inch to the foot and in the exceptionally large model, the scale is ⅛ inch to the foot. Below: Workmen employed in the building of a model sub-chaser.



Above: Some model smoke stacks. Below: A destroyer, equipped with paravanes which are lowered by means of a special chain. These are pipes towed underneath the vessel to protect it from mines. Note catapult and two airplanes.

THE Washington Navy Yard is the only ship plant in America which designs and builds vessels which never are launched, which never pulsate to the throb of mighty engines and which never hear the song of the surf nor feel the surge of battering waves against their hulls.

Thirty-five of the most remarkable battleships, cruisers, destroyers, gunboats and supply ships which ever were created by human hands have been built under Uncle Sam's naval direction. Difficulties of design and conundrums of construction have been solved in these "ships that never sail." This phantom fleet really consists of miniature models of historical ships. It is used for educational purposes. You will see it occasionally on display at popular expositions or international fairs. Visitors to the Philadelphia Sesquicentennial became acquainted with the Lilliputian likeness of notable American vessels. A number of the models were exhibited in Brazil several years ago when that country fostered an international exposition.

(*Continued on page* 449)

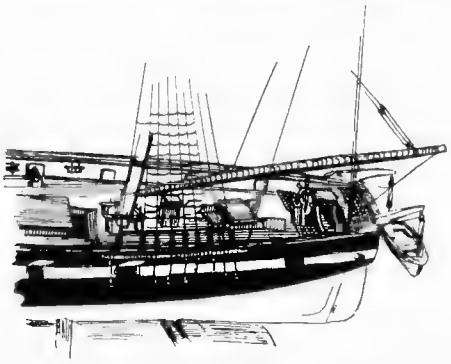
MODEL DEPARTMENT

Building a Model *of the* U. S. Brig of War "Truxton"

By WILLIAM A. CROSBY

PART II

(Continued from the August Issue)



The above sketch illustrates the stern deck arrangement of the model, the construction of which is here described.

THE molds are best made of heavy cardboard and slotted up in the center so that they will fit snugly over the keel, 3, where they are glued in place. The bottom edges of these molds come down to a line, the thickness of the proposed planking, above the rabbet line. The strip of cardboard which is cut out of the slot may be left attached to the center line of the mold and bent up and glued securely to the top of the keel, 4. Each mold must be perfectly vertical to the base line, which may be the top of your work table, and must also be set so that it is at right angles to the line of the keel. Each mold may be secured to the other by means of short strips of cardboard bent between each mold and fastened to the stem and stern by a similar process. When completed they will make a rigid structure.

In making the molds, set them in place beginning at the bow and working aft. The stern or transom will not go in place until the planking is complete for this is on a slight slope and must be worked in place and cut to fit.

In models to be made from a solid block, it is customary to mark off the sections and make templates of each mold which may be held in place up against the hull to see that the shape conforms to that of the drawing. Another way is to build a model in lifts of soft wood and so spacing these lifts that each will represent a horizontal section of the model, 5. This method, though, makes it necessary to have a full size plan view of the model and also a complicated system of "water lines" from which the various lifts may be made. However, if you would rather build your model in lifts or from a solid block of wood, it is relatively simple to secure the dimensions from the sheer and deck plans and then, marking off their spacing, make exact templates from the body plan and hold these up against the wood, at their exact spaces, to show whether or not the shape is correct. This method is far simpler than the planking job and you can make a model which will be fully as accurate if you will but take the time.

Planking, of course, is a real job, but it can be done if the builder will take the time. There is a grade of mahogany colored cardboard, not too heavy and not too light, which will do excellently for this. It may be cut with scissors and since it is not rough finished it will take paint nicely. It also has the property of staying put when once glued in place. Probably a medium grade of Bristol board will do the work as well, but this mahogany colored material is better because it may be used for the hatches and trim also and when shellacked it presents a particularly neat appearance. Some kinds of note books and pads have covers of this material, but if you cannot secure any, the Bristol Board will have to do.

In the writer's model, even the molds were made of this material, glued in place on the keel at the proper spacing. Of course it is necessary to use a heavy glue for the work and it is even a good plan to shellac each glued joint after it has been made. This will keep the weather out and prevent the glue from loosening up when things are damp.

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the November contest must reach us on or before the 25th of August.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 230 Fifth Ave., New York City.

The planking is glued to the edges of the molds and may be held in place, while drying, by means of little metal clamps such as are used sometimes for battery terminals.

The planks are not straight. They are narrower at the ends, with one or two exceptions, and curve in a slightly reverse shape, 6. This is due to the fact that the actual girth around the sections near amidships is considerably greater than the forward sections, yet the same number of planks must be used throughout. In the shape of the sections near the stern, it is quite apparent that there is a long, rather easy curve from the bottom but as it goes up the turn becomes very sharp indeed, then out and finally another sharp curve and so to the edge of the deck. The last two or three sections present a reverse curve and it is necessary to have the planks extremely narrow where they cover the sharpest part of these curves, otherwise they will not lie up against the mold and the ship will not have a smooth appearance.

Since there must be as many planks on these last sections as on any of the others, it is customary to work the lower planks, where they come almost straight, so that they are extremely wide where they rest against the mold. This will give you sufficient coverage so that when you reach the places above where the planks must be narrow, you will have material with which to bring the planking all the way up to the deck without having to insert any extra planks.

Before your molds are erected on the keel or directly from the sections of the body plan, you may take a pair of dividers and space off the first sections and the one amidships so that each has an equal number of divisions, but remember that these spaces will be much wider amidships than forward. By looking at the midship section you will notice that it slopes up from the keel with a turn in it about half way up. The planks should be just a little narrower here than on the straighter part so that when put in place they will fit up snugly to the mold.

The divisions should be marked off on the forward and 'midship sections and then we are ready to begin the actual planking. Remember that the narrower the planks are, the better they will look.

Start with the lowest plank, the one nearest the keel. This is called the garboard strake. The lower edge of this will follow the rabbet line on the keel and you will find that when it gets up forward, that it will round a little to comform to this line. The upper edge of this plank should be taken directly from the marks on the sections forward and amidships. Scratch these section lines on the plank and put a dot where the marks come on the molds. From amidships to the stern the plank will widen out rapidly so that when it reaches the stern post it will probably be three-eighths of an inch wide. Mark this on the plank-to-be also.

Now place the marked plank on the work table and with a thin, straight piece of wood, (called a batten), secure it to the plank by driving pins through both and into the work bench. Allow the batten to make a fair curve throughout its length by holding the ends by pins also, 7. Now mark off the curve and cut out the plank following this line. Keep the section marks upon the planking material so that when you cut the next plank its edge will exactly correspond with the one just cut off. Then, if you have any small irregularities in the plank, the two edges will fit together exactly.

Start all the planks at the bow by putting a drop of glue on them and clamping securely to the wooden stem. Lay glue along the rabbet line and also on each mold edge. When the second plank goes on, the upper edge of the garboard strake will have glue on it also, thus knitting the entire structure into a strong body.

The first plank, like all the subsequent ones, must be made in duplicate so that one

may be used on each side of the ship. Be sure, though, that both sides of the molds are alike, otherwise there may be trouble. The planks are secured in place, until the glue is dry, by either little clamps, pins or thread, slip knotted and passed around the entire hull and pulled up taut. When the glue is dry, of course all of these are removed. Be sure that the glue is quite hard before you attempt to put on the next plank. You can assist this process by placing the model over a warm radiator or lighted electric bulb.

The second plank is shaped so that its lower edge will conform to the upper edge of the garboard and if the piece from which the garboard was cut is still handy, this edge may be used as it is. However, it is sometimes necessary to take a new piece of material and shape it to fit. This is accomplised by taking a lighter piece of cardboard or paper and clamping it in place so that it overlaps the upper edge of the garboard. By holding the model so that the light shines through, you will see the shadow of the garboard edge and may mark it in with a pencil or punch little holes in it along the edge. These holes should be about a quarter of an inch apart throughout the length of the model.

This piece of paper is placed over the material from which the plank is to be cut and the holes or pencil line transferred by pricking the holes through with a pin, 8. Remove the piece of paper then and use the batten to connect all the pin pricks together with a pencil line. Measure the distance to the upper edge of the next plank on the 'midship and bow sections and then again use the batten to draw in a fair line from bow to stern, this plank being a little narrower at the stern than the garboard but it will still have an upward swing.

After each plank is finished, it is fastened in place so that the correct shape for the next plank can be taken, 9. The procedure for each plank is exactly as outlined and with accurate work a really beautiful job can be made of it.

After the first three or four bottom planks are in place, it is customary to start with the highest plank, known as the sheer strake. From here the work goes downward until there is just space enough left for one more plank, 10. This is made an exact fit and is called the shutter strake.

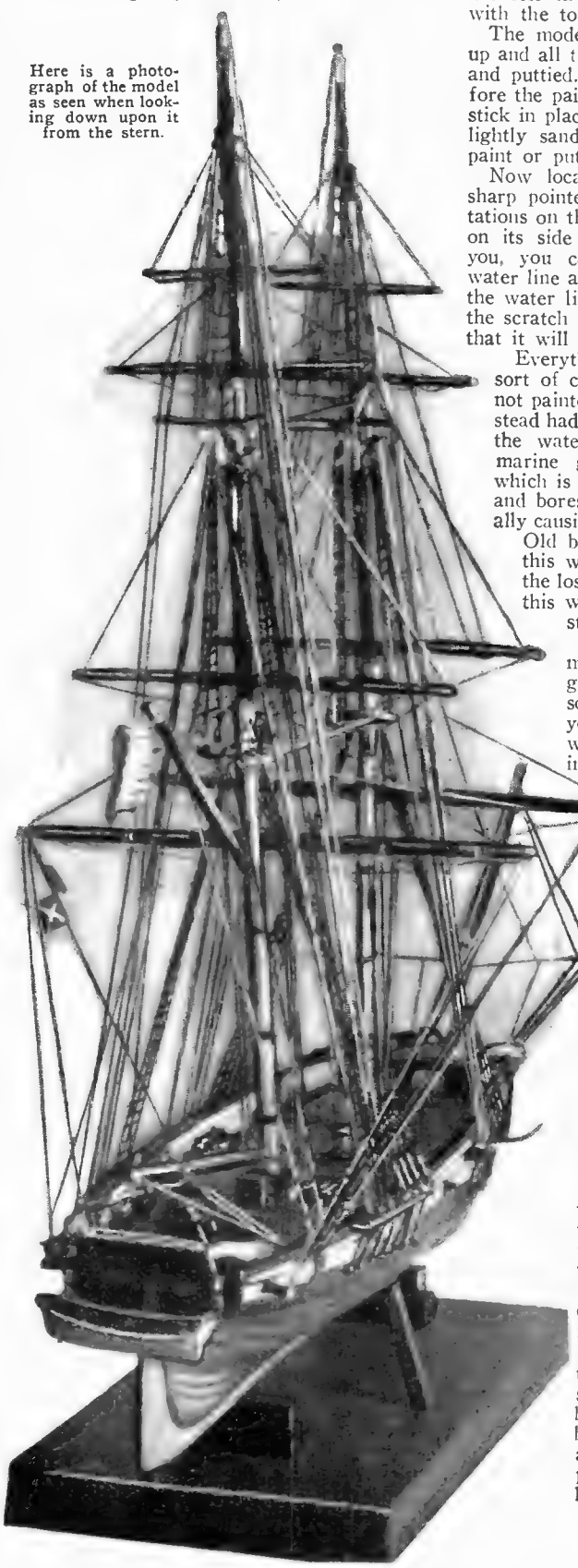
It is advisable to keep each plank all in one piece from bow to stern for if it becomes necessary to make a "butt" between two ends difficulty may arise due to the chance that the planking may buckle a little. Of course such butts would have to occur between the molds and would therefore present a weak spot. Make the planks each in one piece and you will have a better looking model.

The planks are ended on the stem or bow and are cut to follow the line of the rabbet line. At the stern the ends are allowed to run right on out beyond the last mold. The stern now can be put in place. It is cut from the same material as the molds and glued to the after side of the stern post and also to the planking. It should fit snugly in place and when the glue is quite dry and hard (24 hours in most cases), a sharp razor blade may be used to cut off the excess planking material which will stick out beyond. When this is done, take another piece of material and place it over the entire stern in such a way that you can run around it with a pencil. Cut this out and glue it over the stern so that it will cover up all the edges of planking and any rough spots which might have happened. When it is thoroughly dry the entire model should be sandpapered down smooth and where the stern forms an angle with the planking, the edge should be made sharp and cleanly defined.

The next step is to go back to the line drawing again and locate the gun ports exactly on each side. Mark them off and with an old razor blade cut away the material leaving the openings to which the gun port covers will be fitted later on. The main deck will come just below the level of these gun ports.

A narrow slot should also be cut in the stern just above the level of the main deck through which the tiller of the rudder will later be passed.

Next, the frames or ribs are placed inside of the hull. These frames are made of the same material as the planking and are cut in strips about a quarter of an inch wide and with glue on their inner sides are started at the keel and run up to the top of the sheer strake. Of course they are cut away where the gun ports come, 11. Bend each frame a little by hand before putting it into place and then push it down until it is firmly butted against the keel using a small clamp to hold the upper edge against the sheer strake. The frames at the bow will have to have their lower ends bevelled off a little to conform to the line of the rabbet. Each frame is placed right up close to the next one for this is the way in which these ships were really built.



Here is a photograph of the model as seen when looking down upon it from the stern.

When all are in place, the molds must be removed. Cut these down the center and twist away from the planking, afterward putting a frame in each place where a mold has been located. The first and last molds are left in place, but are cut down even with the top of the main deck.

The model should now be turned bottom up and all the seams between planks painted and puttied. The putty must be put on before the paint is dry as this will cause it to stick in place. When dry the hull should be lightly sandpapered to take off any rough paint or putty.

Now locate the water line and with a sharp pointed instrument prick little indentations on the planking. By placing the hull on its side and with an assistant to help you, you can bend a batten around this water line and using this as a guide, scratch the water line throughout its length, letting the scratch into the planking just enough so that it will not be easily covered by paint.

Everything below this line is painted a sort of copper green. These ships were not painted as modern ships were, but instead had a coating of copper plates below the water line as a protection against marine growth and the teredo worm which is encountered in warm salt water and bores its way through wood, eventually causing it to become extremely weak. Old books are full of the dangers of this worm and it was responsible for the loss of many a fine ship. Of course this worm cannot bore into a modern steel hull.

Copper, after it has been immersed in salt water will become greenish in hue and by securing some oil paints such as artists use you can mix a fine color for the work. Squeeze out about two inches of yellow from the tube and add to this a little bit of blue and a tiny bit of red. If you get too much blue, the green will be altogether too dark. Add a little turpentine to this and mix them all together in an old dish or on a piece of wood or glass. Be sure that you get enough to cover the entire hull for it is not an easy thing to match the color again once you have used it all up. A fine brush should be used.

Above the water line the hull is painted black, but between the gun ports we have a white stripe which runs the entire length of the hull from stem to stern. This stripe is exactly the same width as the height of the gun ports. When it is dry, mix up a little black and paint the rest of the hull above the water line. With the black you can cut around the white stripe making nice, clean cut edges.

When the paint is quite dry, the hull should be mounted upon some kind of base so that it will be steady to work on. Use a block of wood at least half again as wide as the model and drive pins through this and into the keel of the model. Take about

(*Continued on page* 459)

Plans for the U. S. Brig of War "Truxton"

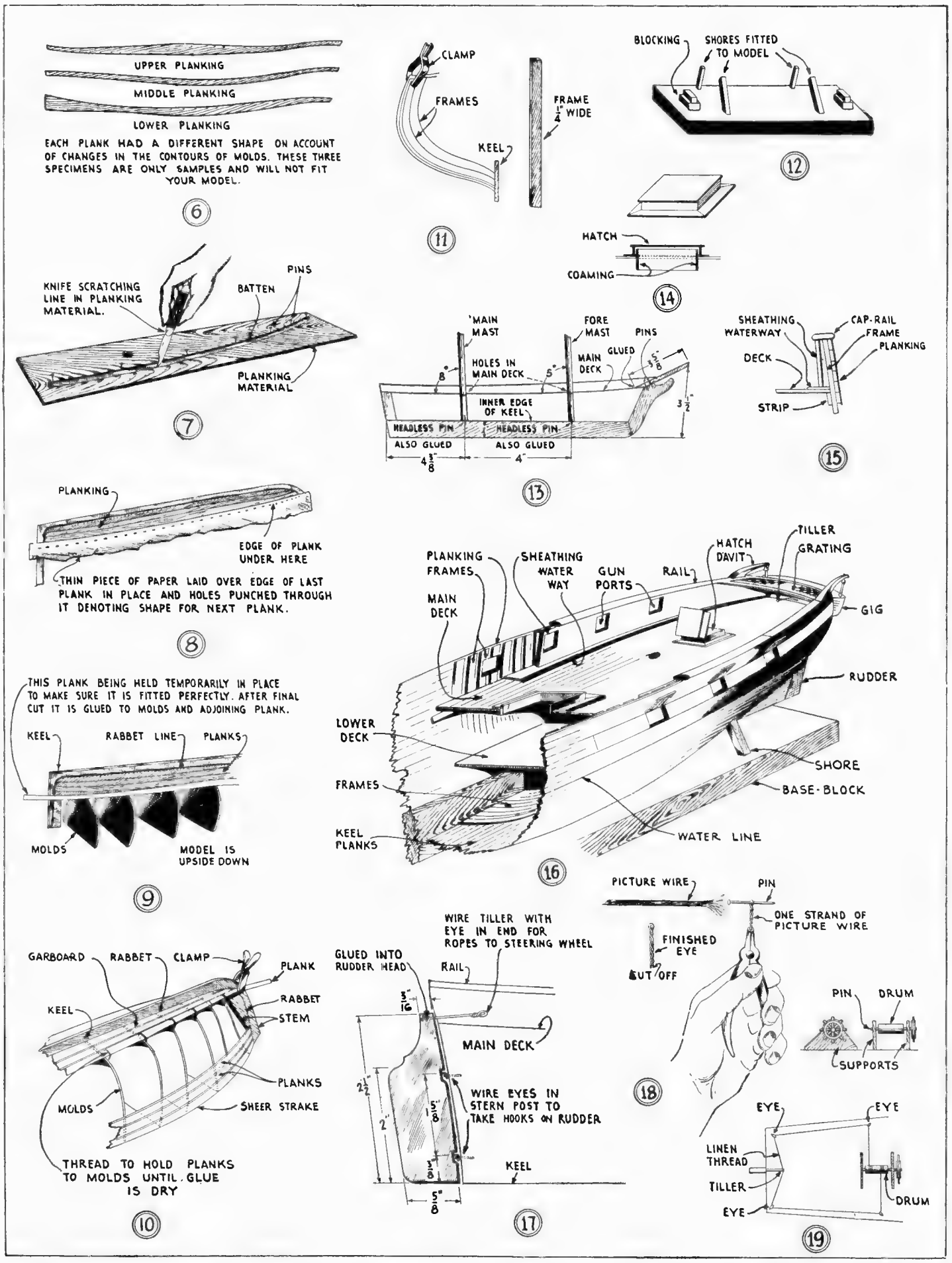
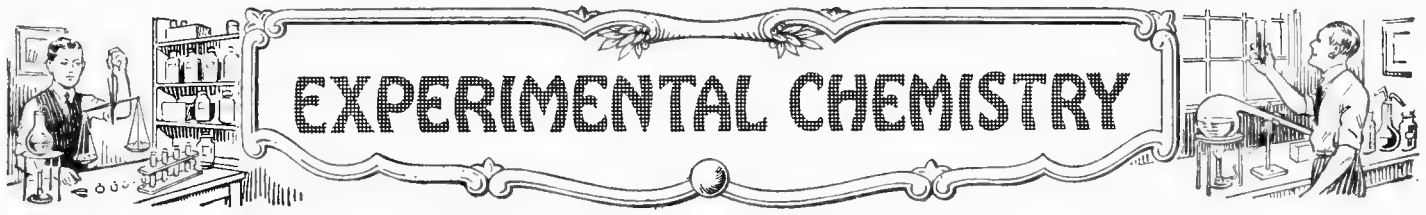


Fig. 6 shows how the planks will be shaped because of the rounded hull. Fig. 7 shows the use of a thin strip of wood as a batten. Fig. 8 shows you how the exact shape of each plank is secured from the last one in place by using a thin piece of paper and punching holes along the edge of the plank already in place. Fig. 9 indicates that each plank is fitted in place, being first cut a little full. Fig. 10 shows how a few planks will look when actually in place. In Fig. 11 frames of heavy cardboard are bent in place and glued. Note the angles of the masts in Fig. 13.

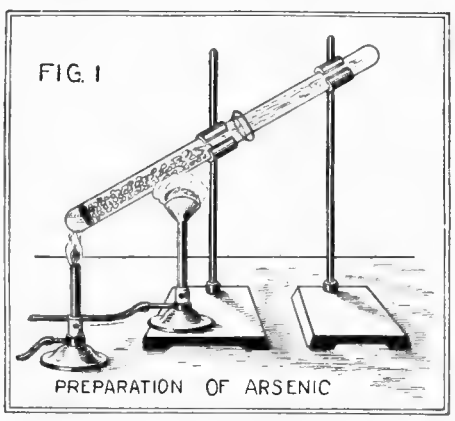


Some Experiments with Arsenic

By DARWIN HARRIS

Some Things Everyone Should Know About Arsenic

ARSENIC, in both the pure and the combined forms, has been known for several centuries. A chemist named Brandt first carefully examined it and gave it a place among the non-metals. Arsenic occurs in certain localities in the native state, but is most frequently found combined with sul-



The manufacture or production on a small scale of the element arsenic. This element falls into the intermediate status between metal and non-metal, and it is a very interesting substance to work with—but remember that it is highly poisonous.

phur, such as realgar (As_2S_2) and orpiment (As_2S_3). The symbol As stands for arsenic, and S for sulphur. To obtain the arsenic, the ores are heated in furnaces. The arsenic, being volatile, passes off and is condensed in chambers. When obtained by this method the arsenic is of a steel-grey color and finely powdered. Purer arsenic is obtained by reducing its oxide, white arsenic or arsenic trioxide, with charcoal. This method can be easily carried out by the amateur chemist. Place a layer of arsenic trioxide in a six by three-quarter-inch test tube, preferably hard glass, to a depth of about ½ inch. Over this place a thin, *porous* plug of shredded asbestos. Break up some wood charcoal into pieces about the size of small peas and place them on the asbestos. Fill the tube to within one inch of the top. Secure the tube in a slanting position, as in the drawing, by means of a burette clamp. For the experiment, two Bunsen burners are shown, but a hot alcohol lamp can be used for one. With the wing-top attachment on the Bunsen burner, heat the charcoal to a red heat. Still keeping the charcoal hot, heat the tip of the tube, where the arsenic trioxide is. It will be vaporized, and its vapor, passing over the hot charcoal, will be reduced to arsenic, with the formation of carbon dioxide gas. The reaction is as follows:

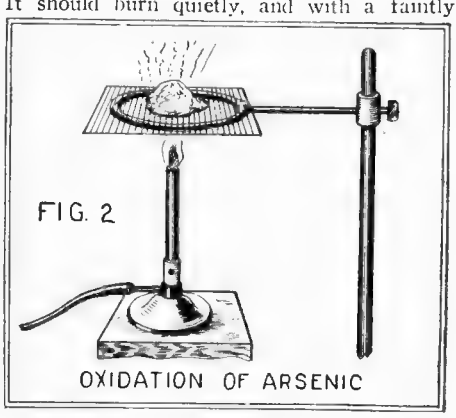
$$2\,As_2O_3 + 3C \rightarrow 4As + 3CO_2$$

Hold another clean, dry tube loosely over the open mouth of the first, so that the arsenic vapor will be condensed and collected. Soon you will notice a dark, mirror-like deposit gathering in the tube, which is the element arsenic. When the arsenic trioxide is all vaporized, allow the tube and its contents to cool. When cool, the arsenic can be shaken out upon a piece of paper.

When heated in air, it oxidizes, giving off white fumes of arsenic trioxide. At a red heat, it burns with a bluish-white flame. Place a little of the arsenic on an iron plate on a ringstand and heat gently. Dense white fumes are given off until the arsenic is all gone. Open the air holes of the burner, while it is still lighted, and hold it above the mass so that some of the smoke will be drawn into the air holes and mixed with the gas. The flame, formerly light blue, will turn a bright bluish-white color. The reaction for its oxidation is:

$$4\,As + 3\,O_2 \rightarrow 2\,As_2O_3$$

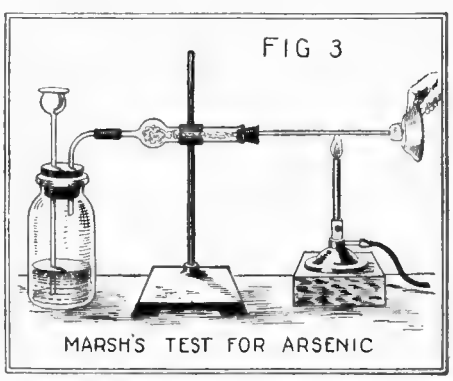
Arsenic forms one compound with hydrogen, the very poisonous gas arsine (AsH_3). It is formed by the action of nascent hydrogen on solutions of arsenic. Arsine is easily decomposed by heat into arsenic and hydrogen. This reaction forms the basis of the well-known Marsh's test for arsenic. Amounts of arsenic as small as a fraction of a milligram can easily be detected. To perform this test, set up apparatus as in the drawing. The bottle contains zinc and dilute hydrochloric acid for generating hydrogen. A drying tube filled with calcium chloride is attached tightly to the outlet of the generator. To this is affixed a hard-glass tube, drawn out to a point at the end and constricted in one or two places. Allow the gas to generate for several minutes in order to drive the air out of the apparatus. In the meantime prepare a solution of arsenic trioxide in hydrochloric acid. When the air has all been driven out, light the jet of gas issuing from the pointed tube. It should burn quietly, and with a faintly



Having made arsenic by reducing it from some of its compounds, it can be oxidized by simple ignition in the open air. Here it is shown supported by a piece of wire gauze over a Bunsen burner. The heat should not be so great as to volatilize the element and cause the air to be permeated with it.

luminous flame. Now add a little of the solution prepared above through the thistle tube. Soon the flame will turn a whitish color and faint fumes of arsenic trioxide will be given off. Hold a cold, dry porcelain evaporating dish in the flame and a dark brown spot will be deposited. The spot is arsenic. Heat the hard glass tube to a red heat with a burner, and notice the dark brown or black mirror-like ring of arsenic deposited further on in the tube. Samples of food, wallpaper, etc., can be tested for arsenic in this manner. When testing for arsenic, however, it is a good idea to make a blank test on the zinc and acid beforehand, to make sure that the arsenic (if any) comes from the article in question.

A bright green arsenite of copper, known as Scheele's green, formerly was used quite extensively as a coloring pigment for wall-



In the above test a poisonous gas is produced, and it is said that the inhalation of a single bubble was fatal to the early chemist who discovered it. Notice the very characteristic garlic odor produced by the flame.

paper. This caused a great deal of unnecessary excitement, for it was thought that you could be poisoned from it. Unless some was rubbed off accidentally and eaten, there is absolutely no danger. To prepare Scheele's green, dissolve a little arsenic trioxide in a strong solution of potassium carbonate. It will probably be necessary to shake the mixture considerably to effect solution. When dissolved, add a solution of copper sulphate and a bright green precipitate will form. Be very careful with it, as it is very poisonous. "Paris green" is another well known arsenite of copper used as potato bug poison.

Making Bengal Lights

Bengal lights, of course, are those firework mixtures which, when ignited, burn with an intensely brilliant white light. They are easily made with little apparatus needed.

Take 16 parts of saltpetre, and mix it with 6 parts of sulphur. To this powder add with frequent stirring 1 part of antimony sulphide. Finally, add 1 part of finely powdered charcoal, and then place in tins for further use.

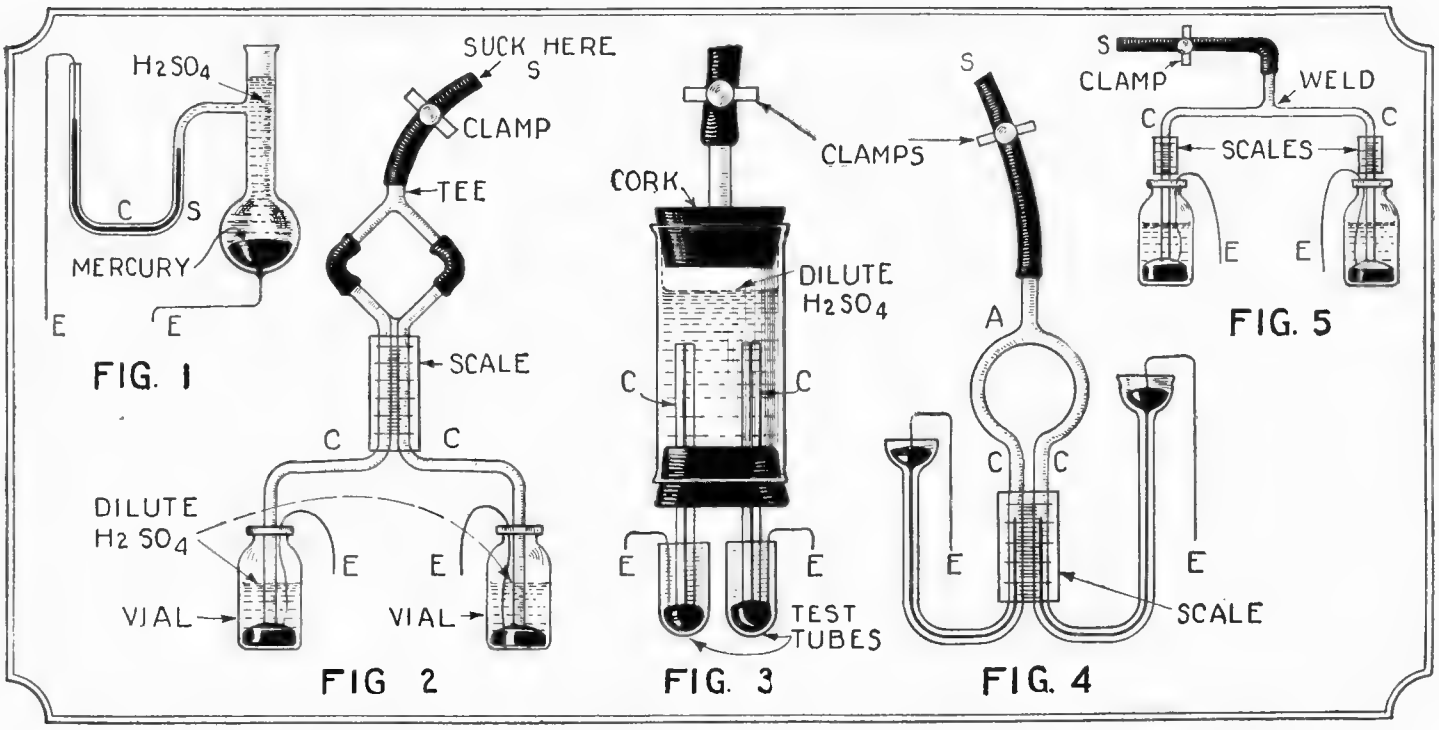
In order to make the Bengal lights, take a few pieces of thin cardboard, and after cutting them out as shown in Fig. 1, roll them up into small cones. Stick the overlapping sides of the cones, then cut out discs of cardboard, Fig. 2, which should be glued in place in the bottom of the cones.

After this pack the cones (not too tightly) with the mixtures, and finally gum a small piece of waxed paper over the top of each cone.

In order to ignite the cones, all you have to do is to stick a match through the waxed paper, and apply a light to it. The match will burn and it will not be long before it ignites the powder.

A Differential Capillary Electrometer

By RAYMOND B. WAILES



The capillary electrometer illustrated here may be called a contribution of the chemist to electricity because the apparatus itself in its setting up, in the use of test tubes, perforated corks and the like, comes within the scope of the chemical laboratory. The operation is supposed to depend upon surface tension, a strictly physical phenomenon and not an electrical one. The construction of the apparatus for the chemist who can do glass blowing, will be quite simple, and it shows how useful glass blowing is to the chemist and experimenter in general.

THE capillary electrometer is used to detect small differences in potential. The usual form of this historic instrument is shown in one of the drawings (Fig. 1). If a current is applied to the terminals EE, the mercury thread in the capillary tube (fine bore tube) will move. The movement is followed with a magnifying glass or microscope. The action is attributed to a change in surface tension between the mercury and the dilute (1:8) sulphuric acid in the tube.

The modifications of the original Lippman type are shown here. In these types two "threads" of liquid are used and the difference between both threads, is measured, thus greatly increasing the sensitiveness of the instrument.

An easily made type of modified instrument is shown in Fig. 2. Here two capillary tubes C and C are bent in the Bunsen flame as shown. Their lower ends dip in homeopathic vials or short pill bottles which contain several cc. of mercury topped with dilute sulphuric acid. The ends of the leads of the instrument are immersed in these two bottles of mercury. The upper part of the small bore tubes are fitted to a tee tube by means of rubber tubing and a length of rubber tubing is then placed in the third leg of the tee tube. By sucking on this tube, with the ends of the capillary tube in the acid, such acid can be drawn up into the tee tube. When this has been done, the ends of the tubes are lowered, so as to dip into the mercury and then mercury is sucked up in both tubes until the ends of the threads are along the scale. The mercury then extends from the little pools in the bottles up into the tubes and terminates at the scale; it should not go farther. A screw clamp closed on the tube will prevent the fall of the mercury threads if all joints are tight. If a small difference of potential is placed across EE the mercury threads will move in opposite directions. If a magnifying instrument is used on these threads, the movement can be stated numerically in terms of scale divisions when the scale is used. Calibrating with known voltages makes an instrument a millivoltmeter.

The instrument should not be used for more than one volt. When not in use the ends EE should be connected together.

Figure 3 shows another method of constructing the capillary electrometer. CC are the glass capillary tubes. They pass up through a cork carried by the large glass tube which is fitted at its upper end with a cork which carries the suction tube. The tube is filled with dilute sulphuric acid. In this form, and also in the form shown in Fig. 5, the mercury columns or threads will present difficulties in observing their movements.

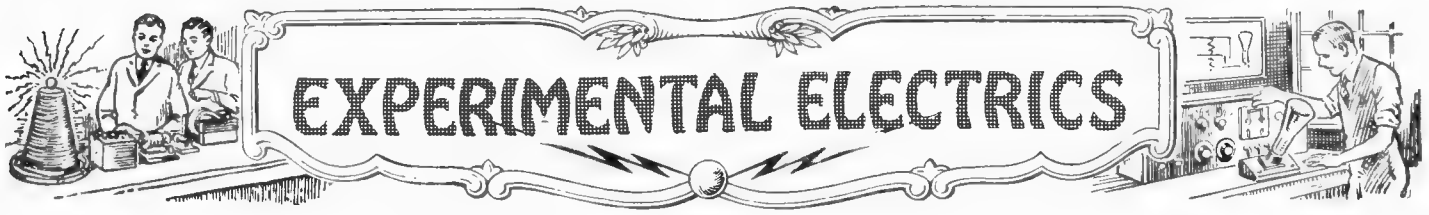
In Fig. 4, a little glass-blowing is needed. Here the capillary tubes are sealed to a tee tube which is bent as shown or a length of capillary tubing is bent to form the main tube and the suction tube by which the acid and then the mercury is drawn up into the tubes is sealed on at A. Cups can be added to each open limb-end or the bore of the tubes can be enlarged by inserting a warm needle into the red hot tube end, and giving it a motion so as to cau e the ends to flare out. The instruments can be mounted in a host of different ways. The ordinary iron laboratory support is the easiest, but a wooden stand can be fitted up which will also serve to carry the binding posts for the leads E, E and a short circuiting switch to short the instrument when not in use.

LIQUID FUEL FROM COAL

ALTHOUGH that condition has not heretofore existed in the United States with its wealth of petroleum resources, Carnegie Institute of Technology officials suggest, there is a growing fear among American engineers that the oil supply is definitely limited. As a result of this scare, American fuel technologists during the past few years have also been studying soft coal as a source for liquid fuel, particularly artificial gasoline. The recent report of the Federal Oil Conservation Board that only a six years' supply of petroleum remains in the proven sands of this country is apparently giving impetus to such research.

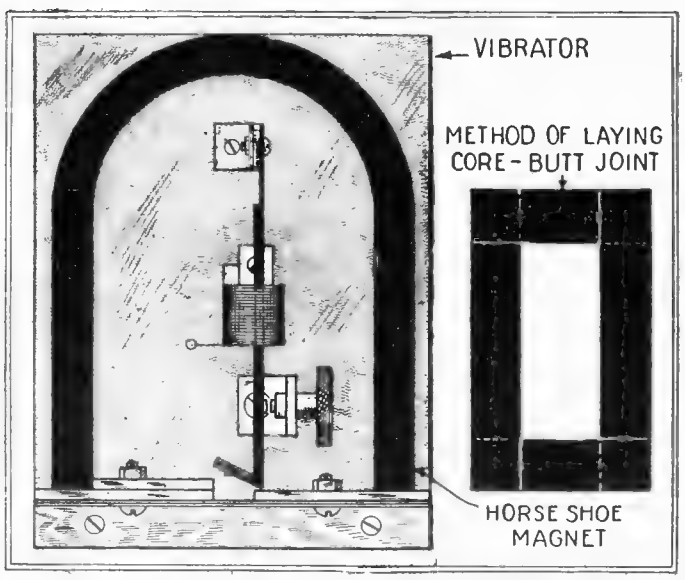
The Bergius method for the production of liquid petroleum from coal, invented by Dr. Bergius, is considered to be the most practical from a commercial point of view of all the methods yet devised, according to the report. With the Bergius method the greater part of a given quantity of coal is converted into liquid fuel. A mixture of pulverized coal and petroleum is heated to a temperature of about 700 degrees Fahrenheit in an atmosphere of hydrogen gas under a pressure of 200 atmospheres. Under these conditions the greater part of the coal is converted into liquid products which may be separated into approximately one-third each of heavy gasoline, Diesel engine oil, and fuel oil.

Fischer, who is director of the Institute for Coal Research at Mulheim-Ruhr has made a liquid fuel oil which he calls "Synthol" by heating water gas under similar high pressures in the presence of a catalytic material. "Synthol," a mixture of alcohol, aldehydes, and hydrocarbons, has already been successfully used for gasoline.

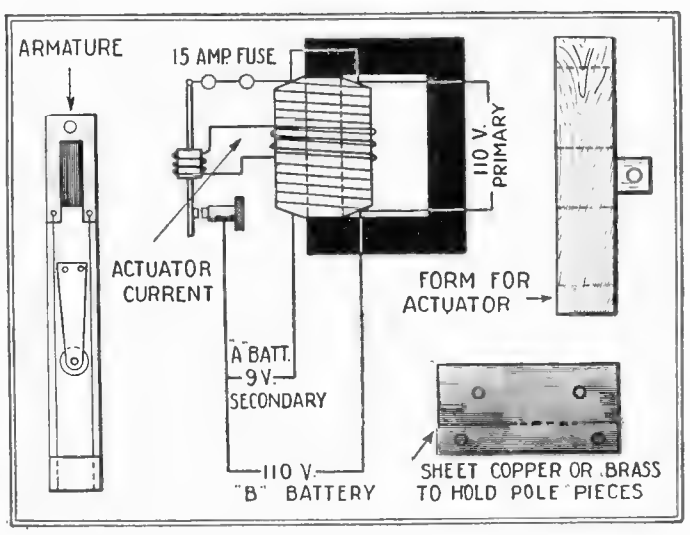


How to Build a Vibrating Type Battery Charger

By RAYMOND C. MILLER



General view of a vibrating rectifier showing also how to make up the magnet core on one of whose limbs the wire is wound.



Full details of construction of the vibrator. Observe particularly the use of a fuse and how the coil is placed upon the rectangular magnet core.

A CHARGER of this type is easy to construct if one has the correct plans and specifications to insure good results. The charger I am about to describe can be built to work on either 25-30 or 50-60 cycle 110-volt A.C. circuit such as is usually employed on lighting systems. I contend that this charger is not only more simple to construct, but is actually more efficient than any bulb type charger. The work is divided into two major parts, the transformer and the vibrating unit. I shall describe the construction of the transformer first because after this is built the hardest work is done.

The material consists for 25-30 cycle use of enough No. 20 D.C.C. wire for 900 turns on a 1¼-inch iron core for the primary and enough No. 14 D.C.C. wire for 75 turns over this primary winding. About 8 or 9 lbs. of core iron will be required. Thin stovepipe iron is ideal for this purpose. A tinshop will let you use their power shears to cut the iron and this is cut 1¼ by 6⅛ and 1¼ by 3¼ inches, an equal number of each being required. About 120 pieces each length will do. Any kind of form will do to wind the wire on as long as it can be removed easily after the winding is completed. The form is 1¼ inches square by 4¾ inches in length. Nine hundred turns of No. 20 wire constitute the primary and 75 turns of No. 14 wire over the primary complete the secondary. The core can then be assembled into the winding. The core is laid butt joint fashion, never having two joints over each other. Each piece of core iron must be coated on one side with shellac to prevent eddy currents with a resultant loss of energy through heat. After the core is laid up so that the 1¼-inch space is entirely filled, the legs are taped to prevent rattling. If the transformer is not to be mounted in an iron case the pieces that clamp the transformer can serve as legs. I advise against placing the charger in a metal case because I have noted that when this is done as much as ½ ampere loss in D.C. output will be noted. This is because the case tends to absorb some of the lines of force from the transformer and as a result this energy is wasted. If you construct your charger for 50-60 cycle use you need 700 turns for the primary winding and 60 turns for the secondary. Some transformers are built with coarse wire on the primary, but a greater number of turns of finer wire will give full core saturation with a low current consumption.

Now that the transformer is constructed we can start work on the vibrating unit. The material consists of a thumb-screw with a point of platinum or tungsten, one Ford coil bridge point, one horse-shoe magnet ½ inch wide with at least 3½ inches between the poles, and 5¾ inches long, a small sheet of copper or brass a strip of wrought iron 1½ inches wide and ⅛ inch thick and about 6 inches long, a piece of slate 5 by 6½ inches, and a short length of No. 24 D.C.C. wire. The moving armature to which the Ford coil point is attached is made of light steel ⅜ inch wide and 3½ inches long. The end that is bent over is weighted with three small pieces of light sheet steel so that there will be sufficient magnetic material for the horseshoe magnet to act upon. The actuator winding consists of 25 turns of No. 24 D.C.C. wire. The transformer is wound with 12 turns of No. 24 D.C.C. wire to furnish current for the actuator winding. The spring to permit the armature to vibrate freely is made in a U form of thin spring steel. This spring is ⅝ inch wide and 1½ inches long.

You must adhere to the above dimensions if you want your charger to work at full efficiency. I had to construct a good many vibrator units before I could even get one to rectify and the unit described above is the result of much work and expenditure of material.

In operation the battery gets only one half of the cycle, but when the contacts are open there is no load on the transformer and practically no current drawn from the A.C. line. The points will last two or more years. When they get worn badly the charging rate will drop off. The points can easily be obtained when replacements are necessary.

To sum up, the more care you spend on the construction of your charger, the better it will work.

Since the experimenter will have most of the materials at hand, the cost will hardly be over three or four dollars at the most. The charging rate will be from four to six amperes, which is sufficient for any battery, but the rate can be lowered by adjusting the thumb-screw. When the charging rate falls off, the thumb-screw can be turned up to raise the rate.

For charging "B" batteries, a 25-watt lamp will pass about ¼ ampere, a 40-watt lamp about ⅓ ampere, and a 50-watt lamp about ½ ampere.

Do not try to charge "B" batteries in series above 100 volts. If this charger is constructed properly, it will consume less than 100 watts. An "A" battery can be completely charged for less than 7 cents!

After the charger is built, the polarity can be determined by any of the usual methods. If you wish to change the polarity of either the "A" or "B" terminals merely turn the horseshoe magnet over. It makes no difference which way you connect the A.C. because the charger automatically rectifies the proper way.

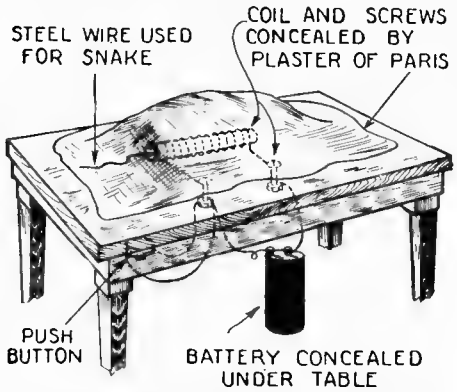
REMOVING BOLTS AND NUTS FROM THE DRIP PAN

A handy and inexpensive tool to have along on a trip is the magnet. The simple horseshoe magnet will answer the purpose. It can be used for recovering bolts and nuts that have dropped into the drip pan, or valve keys that slip behind the valves.

Contributed by E. E. Matheson.

THE TIMID SNAKE

A short piece of glass tubing or a spool, some plaster of Paris, a board, push button, battery, and a small quantity of insulated wire, all of which will be found about the experimenter's work bench, are the requisites for this trick. The wire, one layer, is wound about the hollow core and should be shellacked. After the coil is in place and the wires hooked to the terminal binding posts or bolts the plaster of Paris is applied all over except at one end, the open mouth of the hollow core, which is to be used as the snake's hole.



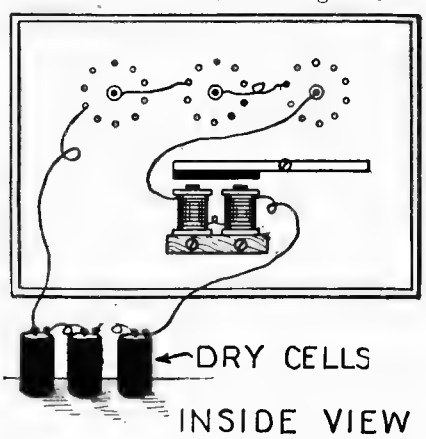
An amusing trick carried out by electro-magnetism. Be sure when you do it to have a good battery well tried out beforehand.

After the plaster of Paris is hard you may paint it green, resembling grass. Now wire it up, being careful to conceal well the wires and battery, and you will be ready for the snake. Take a piece of steel or iron wire and crook it to resemble a snake. Do not make it too large. The size of the snake depends on the size of the coil. Now bring on the audience and have some one try to pick up the snake; when he gets his hand almost on it, push the button and presto, it is in its hole in a flash.—*Contributed by Elam C. Frye.*

ELECTRIC SAFE

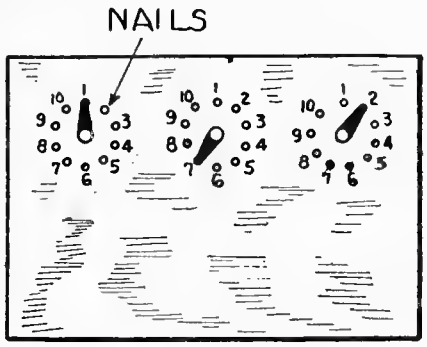
A very useful electric safe can be built by any one from bits of scrap which lie idle in your shop. This safe can be used to store your valuable apparatus, nice little tools, or something of the kind which is attractive to others.

The safe consists of a wooden box which is covered with sheets of tin, or thin brass. A door is made to fit and hinged to the



Inside view of an electric lock or bolt for a tool box or other case to be locked.

box. Before you screw the door on procure two small electro-magnets, two or three dry cell batteries, about 33 one inch nails, some copper wire, a soft iron core, a piece of light but strong wooden strip and three small tin dials. First get out your wooden latch strip, which should be from ½ to 1 inch in thickness, and just a little over half the length of the box. On one end of the board fasten a flat iron armature, pivot the board near the center of the box, taking care to make the end with the flat armature slightly lighter than the other end, then fasten the magnet to a wooden block and screw upon the door just a little beneath the armature; the exact points can be determined by the strength of the batteries and magnets. Having done this you drive nails for contacts through the door in the form of three circles, ten nails in each circle, the remaining three nails are to be driven through the dials and through the center of each circle. The dry cell can be secured on the inside to the back of the box and connected as shown in the illustration. Then the door can be fastened on and a catch made on the inside of the box which will catch the bar as the circuit is disconnected, thus securing it. On closing the circuit the latch will be released.—*By Stanley Plizger.*

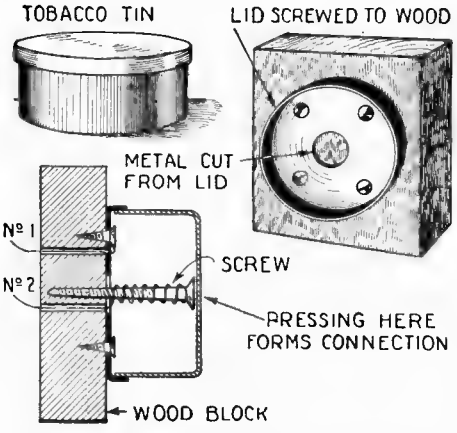


Arrangement of three dials on the electric safe which have to be set in a particular way to allow the lock to open.

A BELL PUSH FROM AN OLD TOBACCO TIN

Those who smoke tobacco usually throw away the very neat pocket tins in which the tobacco is sold. But these tins can be used to hold little tools such as small drills, taps and the like, and for screws and for many other purposes about the shop. Their appearance can be improved by painting them and it is advisable if there are many to label each one neatly with the designation if its contents. In the present article the author describes a substitute for a push button to be made from a tobacco can, and the illustrations show it so clearly that a description is hardly needed.

The lid is attached to a block of wood and one wire is connected to it. A hole is cut in the center and a wire goes through this hole and is held thereon by a screw which projects almost to the height of the box when the latter is pushed into its lid.



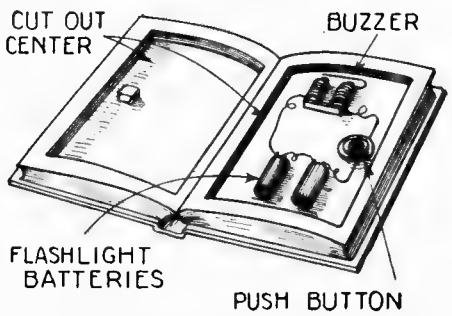
A round tin box is made into an excellent bell push button. The trouble is that round tin tobacco cans are rather scarce now, but others can be used.

The box is now stuck into the lid and, as the metal of these boxes is very thin, the screw can be so adjusted that a light pressure on the center of the box will bring it in contact with the head of the screw, thus closing the circuit and ringing the bell.

There are other ways in which the same idea can be carried out, but this is at least a suggestion of a use for one of these tins and further methods may be left to the ingenuity of the reader.

THE MYSTERIOUS BOOK

A mysterious book can be made by following these instructions. Procure an old book of the novel style or of about the usual size. Cut out the space in the center



An electric book which rings a bell or buzzes or may even give a shock to an unsuspicious person.

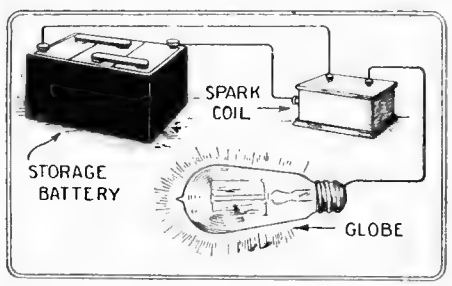
of the pages, leaving an inch margin around the edge to prevent the opening from being seen. Inside on the back cover mount a buzzer (small type). Then mount two flashlight batteries and a push button as shown. Adjust the push button so that when a slight pressure is applied to the covers it will cause the buzzer to vibrate.

If this book is placed under one or two others or held on the table, the noise will cause people to wonder where it is coming from.

If the wiring or mounting screws show, they can be hidden by placing a paper book cover or jacket on the book.—*By L. F. Carpenter.*

CATHODE RAY EXPERIMENT

This experiment which is of the simplest possible order, is based upon the use of a Ford induction coil and a 6-volt lamp such



A cathode ray experiment, using an old electric light bulb to show the light and a three-terminal Ford coil for the potential.

as used on automobiles. The coil is connected to a battery as shown and the wire is taken from the high tension terminal to the lamp, its end being wound around the metallic base of the lamp. On now sending a current through the coil the interior of the bulb lights up with the blue light characteristic of the cathode ray. The wire from the secondary of the coil may be laid upon the glass of the bulb, which will give another effect. The experiments are to be conducted in the dark to get a good effect.—Author please send name.

THE CONSTRUCTOR

Articles of Interest to the Home Mechanic

Twin Express Cruiser

How to Build the "Silver Spray," a Rubber Band Propelled Cruiser

By HI SIBLEY

THE appeal of any toy boat lies first in its graceful lines, then in its performance, and last, in its simplicity of construction.

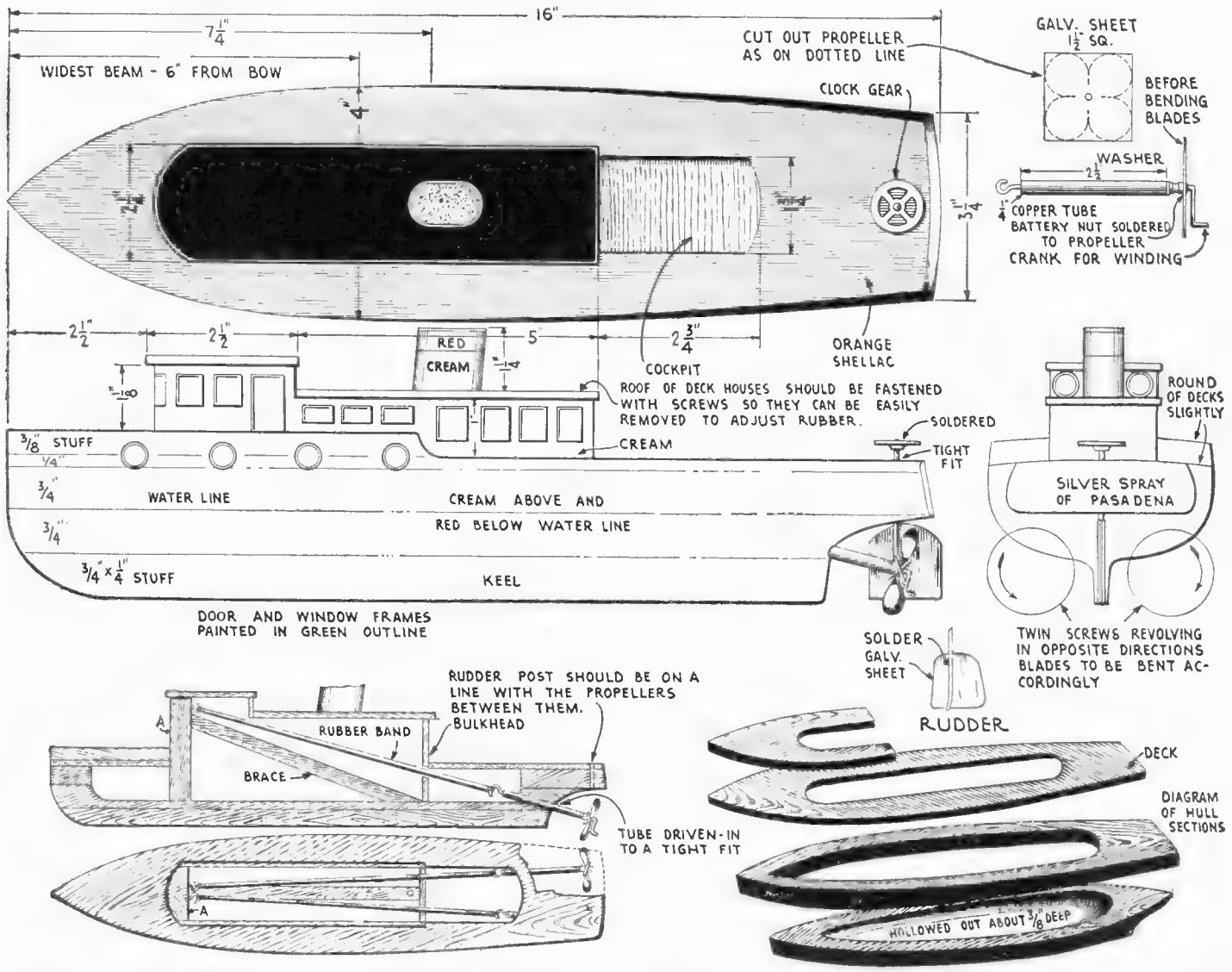
This twin-screw express cruiser is a departure, at least, from the general run of juvenile craft, and is designed with as pleasing lines as its power plant will permit without going into complicated features of construction.

White pine is, of course, always to be preferred to any other wood for toy craft because it is so light and easily worked.

Rough out the hull sections as shown, coat surfaces with shellac and fasten together for the final smoothing up with plane and sandpaper. Bore the two holes to receive the propeller tubes, taking care that they are directly in line with the hooks to hold rubbers on front wall (piece A) of pilot house. If not directly in line the propeller shaft will cramp and lose its efficiency.

Ordinary copper gas feed pipe from auto junk will serve this purpose if it can be straightened out.

After the tubes are driven into place, fit the keel and bulkhead. This bulkhead should come up as high as rubber bands will permit without touching. The object of the bulkhead is to keep water from propeller tube running into forward end of boat. The propeller tube could, of course, be carried up above the waterline, but that would shorten the possible length of rubber bands and reduce the cruising radius of the boat. No harm is done when water gets into rear compartment, as this will tend to keep stern down lower than the bow.



The above diagram contains the full details and gives the complete drawings for the construction of an ingenious cruiser provided with twin propellers, the motive power of which is obtained from rubber bands. It will be observed that each propeller is provided with a crank so that the rubber bands can be wound up. The rudder takes care of any unevenness of power from the rubber bands and also any irregularity in the pitch of the propeller blades. The model is made up of pieces of wood, hollowed out and screwed together as indicated.

Ordinary copper gas feed pipe from auto junk will serve this purpose if it can be straightened out.

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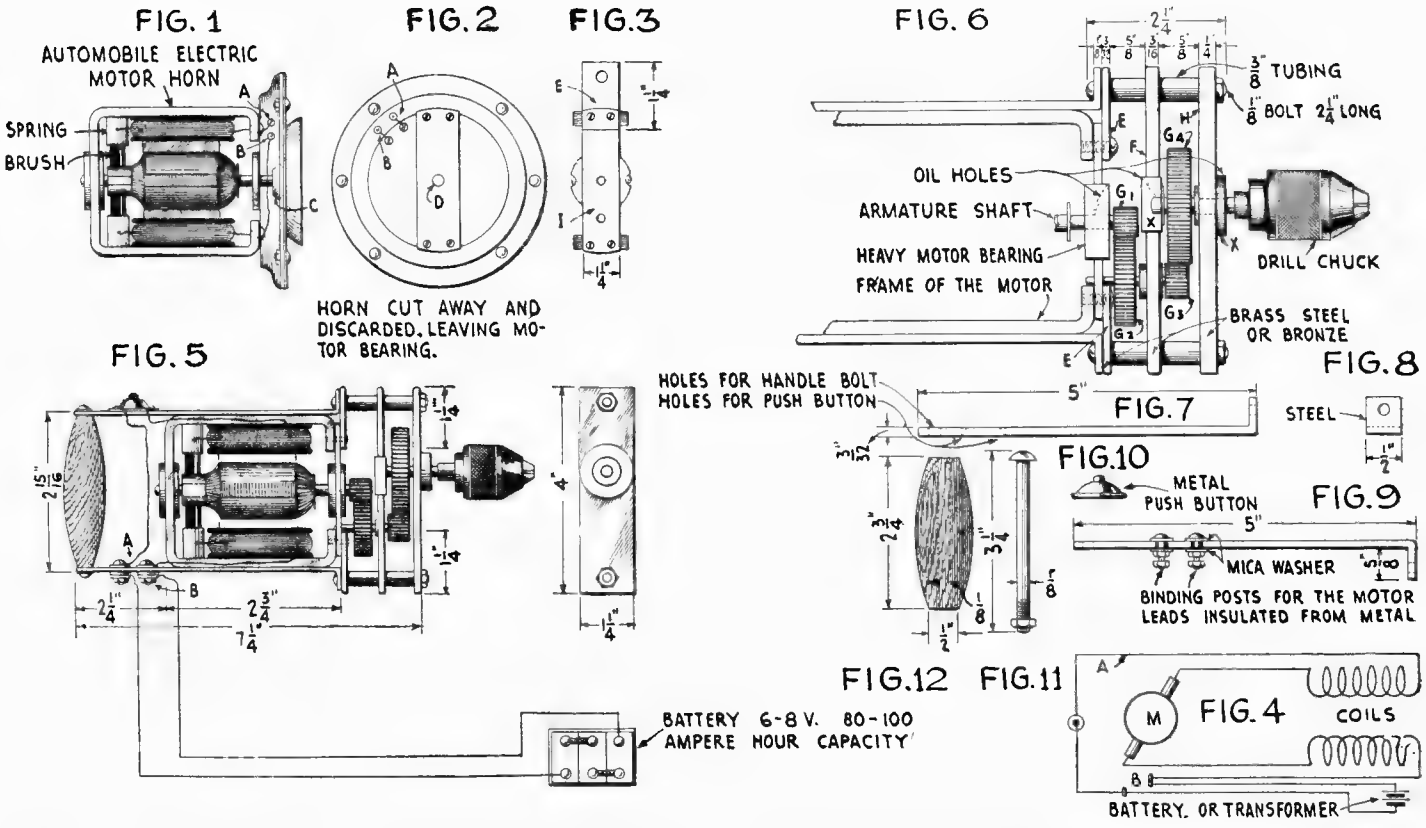
Bend the propeller blades so that one will turn to right and the other to the left. The rudder post should fit snugly so that it will stay in the desired position. If the builder does not care to go to the trouble of fitting a clock gear as a steering wheel, simply bend over wire rudder post for a tiller.

Three or four long flat rubber bands will give best results, but very good speed can be attained with ordinary bands looped together.

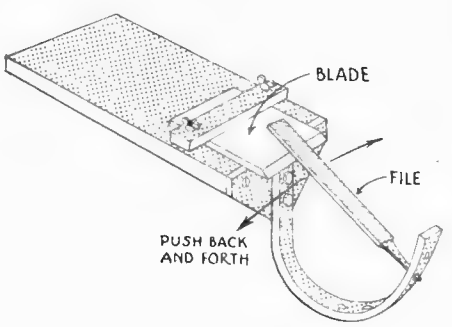
Making an Electric Hand Drill



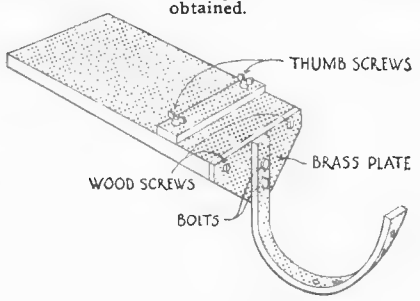
This drill was constructed from an old electric motor horn taken from a junked auto, a chuck obtained from a local hardware store and several gears and other parts found about the house. It has been in use by the author for three months. In Fig. 1 the old automobile horn is illustrated minus its casing. Fig. 2 shows how the end was cut away, leaving the bearing, and Fig. 6 shows the attachment of the gears to motor shaft. F and H are the main standards for the gears and drill chuck. These are 4 inches high, 1¼ inches wide, the former being 3/16ths inch thick and the latter ¼ inch thick. XX shows the reinforced bearings produced by brazing part of the bearing material to the standard at the point where the shaft hole is to be drilled. The oil holes are 1/16 of an inch in diameter. Care must be taken when measuring off the framing to give the gears the proper clearance. The gears used were brass spur gears, 24 pitch and with a ¼ inch face. G1 has 12 teeth and is ½ inch in diameter, G2, 30 teeth, 1¼ inches in diameter, G3 the same size as G1 and G4, has 48 teeth and is 2 inches in diameter. The speed of the drill is 600 r. p. m., and power is from a 6-volt battery. The drill is designed for light work such as drilling radio set panels.—WILLIS L. JONES.

Hints for the Mechanic

BLADE SHARPENER
AWARDED $10.00 PRIZE



The illustration above shows the completed blade sharpener which can be used for sharpening the blades of scrapers, planes and the like, by means of an ordinary file. Expert results are easily obtained.

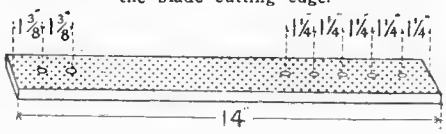


This diagram indicates the apparatus with the blade removed. It will be observed that two thumb screws and a metal bar are employed to lock the blade to the face plate. These parts are made of steel.

A New Department

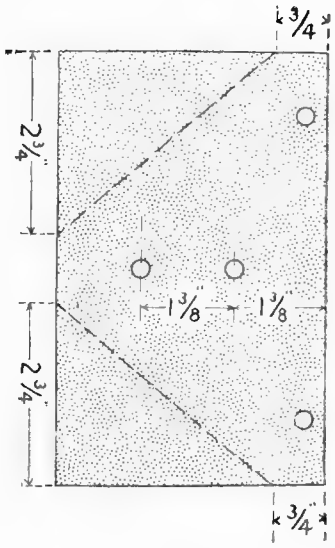
BEGINNING with the May number we started this new department—"Hints For the Mechanic," in which we intend to publish wrinkles useful to mechanics in general. You can help us with this department by writing a brief description of your favorite shop wrinkle and sending this to the editor of this department, together with a pencil or pen and ink sketch of the wrinkle. The ideas published herewith will give you some idea of what we want. Our draughtsmen will make the necessary mechanical drawings, so you need not send us finished drawings. We will pay $10.00 each month for the best Wrinkle or Hint sent in; others published will be paid for at space rates. Address all letters to Editor, Hints For the Mechanic Dept., in care of this magazine.

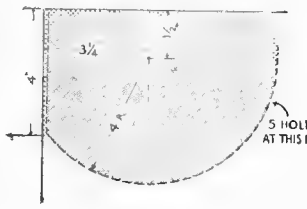
The illustration below indicates the brass strip which is to be curved and fitted to the end plate. This holds the end of the file. The various holes are for positioning the file for different angles of the blade cutting edge.



After this piece is made, bend it to the radius indicated at the right.

From a sheet of brass, cut the end plate as indicated at the right. When this apparatus is complete, placing the end of the file in one of the holes as shown in the first illustration and rocking the file back and forth sharpens the blade.



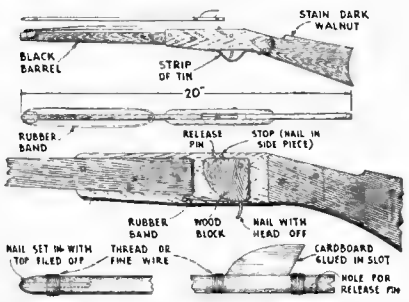


The file holder is bent along the radius indicated at the left. This might be a wooden block made as shown.

(*Continued on page* 469)

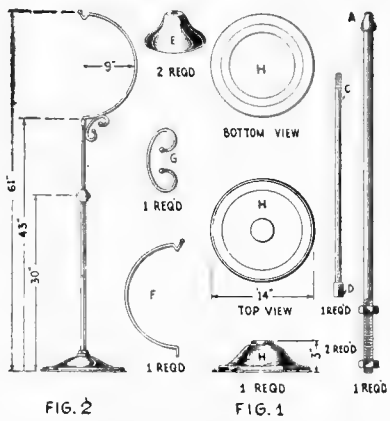
HOW TO MAKE IT

SLING SHOT GUN



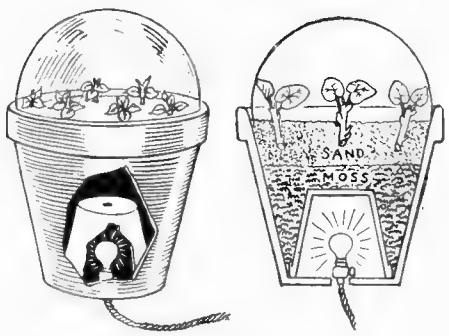
The growing popularity of the bow and arrow has left certain big game hunters wavering between the rifle and the bow. The combination above should satisfy the needs of both.—H. Sibley.

BIRD CAGE STAND



An ornamental bird cage stand can be constructed without much trouble by following the plans shown in this illustration.—M. N. Kirkwood.

PROPAGATOR

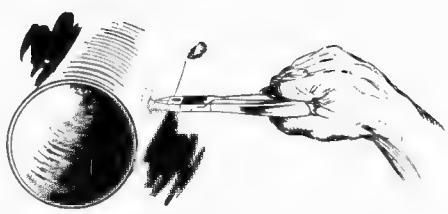


The propagator illustrated, will root cuttings of greenhouse plants very quickly. Two plant pots are used, one eight inches or more in diameter, and the other four inches. An electric light bulb is placed in the bottom of the large pot, and the small one placed over it. The large pot is then filled with moss and sand.—Author send name.

GIANT GOOSEBERRIES

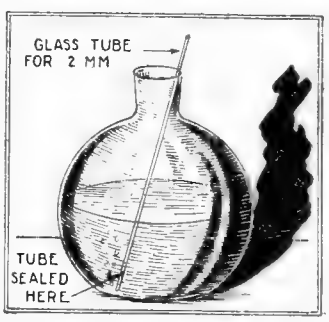
An interesting way of growing giant gooseberries is by feeding the fruit with water. When the berry has just formed, place saucers of water under the branches so that the bottoms of the berries just touch the liquid. The fruits will absorb the water to a surprising extent and swell rapidly to a huge size. Berries treated in this way are exceptionally juicy.—S. Leonard Bastin.

INNER TUBE REPAIR



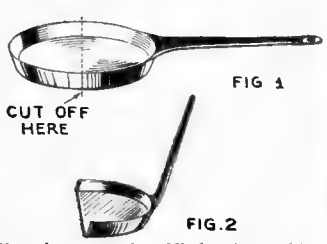
It is often desirable to insert a patch inside of an inner tube as well as outside when repairing a large hole. To do this place cement around the hole inside to hold it in place.—L. C. Ferguson.

STIRRING ROD



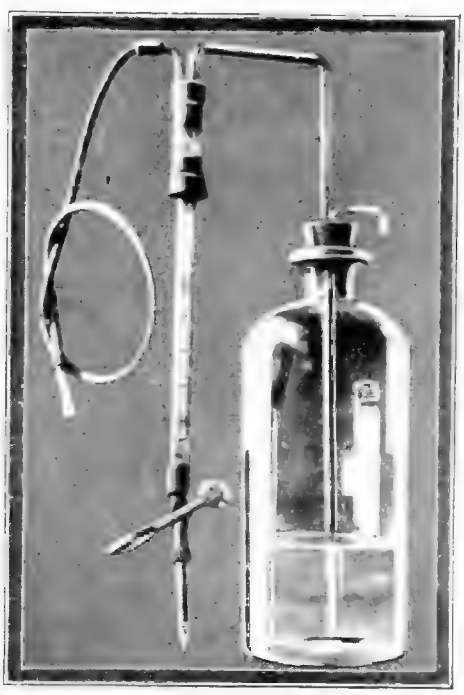
A stirring rod may be easily constructed by taking a piece of glass tubing and melting one end in a gas flame. The end is then drawn out and the fine pointed end resulting, fed into the gas flame until a round ball is formed on the end. The end may be flattened, to facilitate stirring. This may be accomplished by reheating the end and pressing it while soft against a piece of metal. The advantage of this type of stirring rod is its lightness. —Author send name.

HANDY DUST PAN



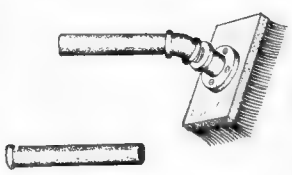
By cutting along a dotted line shown in the illustration here, an old frying pan may be made into a useful dust pan. It may be painted to give it a neat appearance and any small holes may be filled with solder. Fig. 2 shows how the completed dust pan looks.—Mauro Feliciano.

DISPENSING APPARATUS



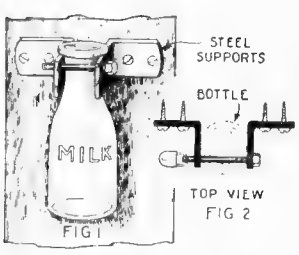
To get the desired amount of solution from the bottle, you simply suck the fluid into the graduated tube by a little pressure on the nipple of the hose. This solution is then drained by releasing the spring trip. The amount is accurate and there is no muss when using this device.—Raymond R. Roy.

SCRUB BRUSH HANDLE



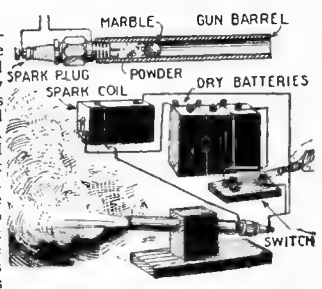
An ordinary scrubbing brush may be equipped with a handle to facilitate scrubbing the floors, by constructing a pipe handle as shown. The handle may be made any desired length and may be capped at the end if desired. It should be constructed of three-quarters to one inch iron pipe.—M. Kesak.

MILK BOTTLE HOLDER



To prevent the theft of milk, a very simple device can be installed on the porch as shown in the above illustration. Procure two pieces of steel and bend them as shown. Two holes are drilled near the top to hold the bolt and padlock as indicated in sketch. — E. J. Wilhelm.

TOY CANNON



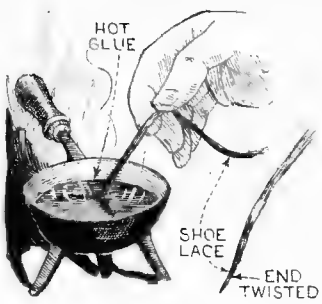
A small cannon may be constructed quite simply from parts found around the garage. A spark plug and Ford spark coil are used. A piece of pipe is threaded to fit the spark plug, and the barrel thus formed is mounted in a wooden block. The spark plug, spark coil and batteries are connected together as shown. A small amount of gun powder is dropped into the barrel and a marble put on top.—Author please send address.

WRINKLES
RECIPES & FORMULAS

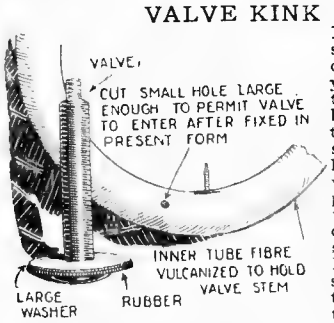
Edited by S. Gernsback

SHOE LACE REPAIR

Much trouble is often experienced with the metal tips coming off shoelaces. The best way to fix them is to dip the laces in glue and then twist the ends to a point. When the glue has dried, the tips will be quite hard. — Ford Bentley, Reporter No. 19883.



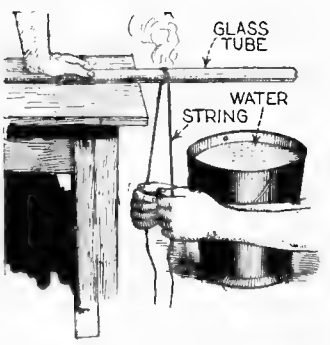
VALVE KINK


VALVE
CUT SMALL HOLE LARGE ENOUGH TO PERMIT VALVE TO ENTER AFTER FIXED IN PRESENT FORM
INNER TUBE FIBRE VULCANIZED TO HOLD VALVE STEM
LARGE WASHER
RUBBER

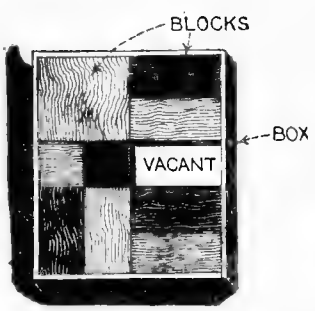
If the valve stem has pulled out of one of your inner tubes, it may be repaired by the method shown at the left. A large washer and a piece of inner tube are placed over the valve stem as shown. It is then inserted through the hole cut in the inner tube. —A. M. Peterson, Reporter No. 20394.

CUTTING GLASS TUBING

A method of cutting large glass tubing is shown in this illustration. A string is placed around the tube as shown and worked up and down rapidly, until the friction causes the cord to begin to smoke. A drop of water is then dropped onto the heated tubing, at the point to be cut. — V. McCloskey.



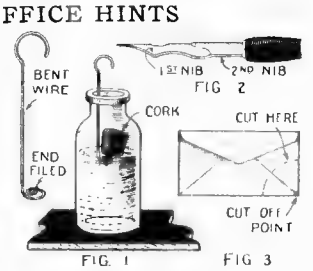
BLOCK PUZZLE



Here is a puzzle that will give you quite a lot of amusement. The problem is to move the blocks, without jumping or raising from the bottom of the box, so that the large square in the upper left corner finally reposes in the lower right corner. — Truman R. Hart.

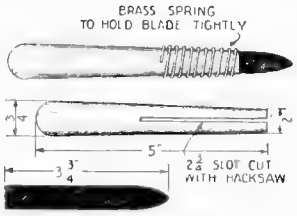
OFFICE HINTS

Two pens placed in the holder enable one to write for a much longer time without dipping the pen. A funnel can be easily made from an envelope and a cork easily removed with the wire holder shown. —Vernon Miller.

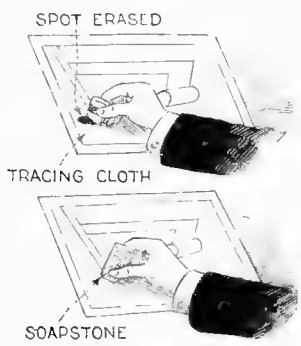


STENCIL KNIFE

A handy stencil knife can be easily made from a length of hacksaw blade, ground to the shape shown and sharpened. The blade is placed in a slotted wooden handle and fastened by means of wire. —Contributor send name and address.


BRASS SPRING TO HOLD BLADE TIGHTLY
5"
2 1/2 SLOT CUT WITH HACKSAW
HACKSAW BLADE - TEETH REMOVED GROUND TO SHAPE SHOWN AND SHARPENED

REPAIRING TRACING CLOTH

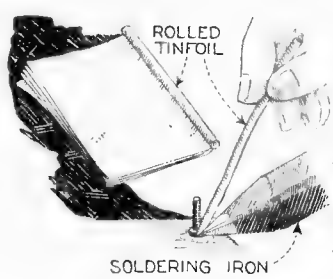


When erasing on tracing cloth, a spot is often rubbed, removing the lustre and blotting if ink is applied. This difficulty may be overcome by rubbing the spot with soap stone. — Leonard Keiser, Jr., Reporter No. 27612.

INK REMOVER

It is often very difficult to remove ink stains from your fingers. This wrinkle explains how it may easily be done. Wet the end of a match and rub it over the spots. Wash your hands in cold water and watch the ink disappear. — Mrs. Nina Jeffers.

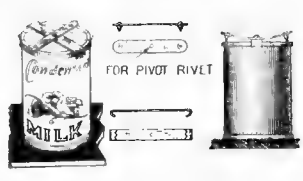
EMERGENCY SOLDER



Emergency solder may be made, by rolling several layers of tin foil together. The solder made in this way is a little harder to melt than ordinary soft solder, but it serves admirably in a pinch. — Donald Kerst.

MILK CAN OPENER

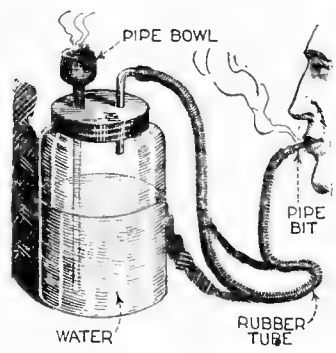
An evaporated milk can opener which has the added advantage of sealing the can when not in use is shown in the illustration on the right. It is constructed of spring brass or any flexible material.—George D. Hugo.



COPYING INK

If a little sugar is added to ink, a copy of writing may be easily taken off by laying a sheet of unsized paper, dampened with a sponge, on the written paper and passing lightly over it a flat iron very moderately heated. — Vernon Miller.

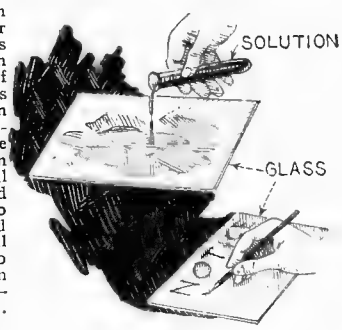
WATER PIPE



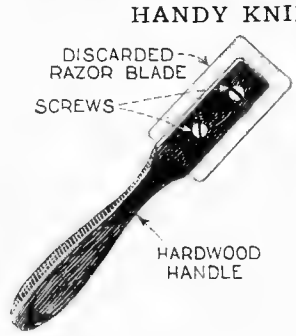
To make a simple and cheap hookah or water pipe, secure a fruit jar and lid to fit; two wooden pipe stems; rubber tubing; old pipe with a stem and a small amount of paraffin or sealing wax. It is assembled as shown in the illustration at the left.

WRITING ON GLASS

If a solution of three or four drops of glue in an ounce of water is spread on glass smoothly, and the glass laid in a horizontal position and allowed to dry, a lead pencil will be found to write upon the glass. — Homer E. Black.



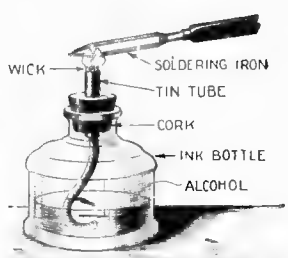
HANDY KNIFE



A discarded razor blade and a wooden handle fastened together as shown in the illustration on the left make a handy device for ripping seams and other work in which it is necessary to have a sharp knife. — Leo W. Born.

SOLDERING IRON HEATER

A device that is very handy for heating a small soldering iron can be easily constructed as shown at the right. A small ink bottle with a cork and wick are used with alcohol as a fuel. —Leon Fischer, Reporter No. 29844.



SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

DUNNINGER AND SPIRITUALISM

Editor, SCIENCE AND INVENTION:

Dunninger's Spiritualistic Investigations are most disappointing. We, myself and thousands of good United States citizens, would welcome exposés of spiritualistic fraud, if fraud there be. Most people have observed much of so-called spiritualistic "manifestations,"—phenomena anyway which they are anxious to know the how of. But Dunninger's explanations are worse than bad,—nonsensical, and truly unscientific. They explain nothing. In a journal of your stamp, they are out of place. We know no more after than before reading his articles. For fifty or sixty years I have been studying spiritualism, along with other dark questions; and I have observed much that no Houdini nor Dunninger has so far explained, or approached in duplication. And nothing I have learned indicates that they can explain very much of the so-called "manifestations." Yet I am not a spiritualist. With the great majority of thinking people, I must doubt until there be better evidence. But investigation that does not investigate,—just wild guesses that are more foolish and unscientific than the thing investigated,—is not enlightening to the discriminating student.

Dunninger's last article (May) tells us of the pictures on the back of vest, bolstered up with ventriloquism. This guess is plainly absurd,—too ridiculous for a place in SCIENCE AND INVENTION. The room, he says, was pitch dark, so dark no possible shadowy outlines of objects were visible. What sort of painted pictures could be seen in such darkness? What shining or phosphorescent coloring could produce the desired effect, and not fail, itself, to give sufficient light to give the whole scheme away? How many vests would be required, and how about changing to show so many "Heads?" The idea is far more ludicrous and unreasonable than spiritualism itself. Guesses more sensible and scientific are easily possible, if guesses were in order. Even the explanation of the voices via ventriloquism, is not plausible. "Throwing the voice" is not a performance workable in the exact manner, and to the degree, that Dunninger assumes. It cannot successfully be done under conditions as he depicts them. I spent much of my younger life mixed up with stage "magic," and I should be able to guess, as Dunninger does, if guessing were good business. But it is not. The rule is that some "wise guys" of the audience always "know how the magician does his tricks;" but the rule is also, that not one in a thousand guesses correctly. Dunninger would sneer at such "wise guys," and yet he practises the same conceit.

Were I more literary, I might voice my opinions in terser terms, but I hope I have made myself plain. We still await, after all these years of boastful talk by self-styled exposers, for some real exposés of spiritualism and kindred subjects.

F. L. UNDERHILL,
Minneapolis, Minn.

(The strange thing about Dunninger's Spiritualistic Investigations is the fact that he has the evidence, indicating that the tricks that are exposed by him are actually used. Consequently he *knows* how the mediums do their work. Of course only unusual examples of deceptions have found their way into these pages. Thus, simple effects in which the medium uses rubber gloves for producing wax hands, simple palming, independent voices by the aid of a trumpet held to the medium's lips or produced by an assistant in the circle, lights floating about the room and dangling from the end of a collapsible cane and many other phenomena, are too well known to be given valuable space in a publication of this sort.

Suppose that you mention the name of the medium and what you believe you saw. Perhaps we will be able to give you that medium's method of operation and also some information as to when, how and where that medium was exposed. Our files contain a great many names and lists of numerous effects. We, too, are anxious to obtain spiritualistic phenomena which are not fraudulent on their face. We likewise stand behind our offer of $21,000, $11,000 of which will be paid to any medium who will produce any effects which we cannot duplicate.

Ventriloquism is used to a great extent in spiritualistic circles. It is really remarkable how much easier it is to fool a person in the dark than in daylight. Suppose you try this simple stunt:

Unknown to your spectators, pick up one of several trumpets, previously set at your feet, in a totally dark room. Whisper through the trumpet and at the same time direct the large end of the horn into different corners of the room. Your spectators will swear that the voices floated all about them. Perhaps because a human being cannot prick his ears in the direction from whence the sound is coming, he is completely fooled.—EDITOR.)

SPIRITUALISM AND MAGIC

Editor, SCIENCE AND INVENTION:

I am very much interested in all articles in your magazine and, because of having Magic as my hobby, naturally enjoy all items related to this.

I have enjoyed the spiritualistic articles and also those on Astrology. I am sorry to see that the articles by Dunninger on spiritualism have been dropped and hope that they will soon re-commence.

Believing all spiritualism to be a fraud, I will herewith give my theories as to how people delude themselves with some of the phenomena. For instance hallucinations, where visions of the departed come to the living, they are most likely a result of continually brooding over the loss of the dear friend who comes in the vision and, through something akin to auto-suggestion, you believe you see said friend, thereby employing your imagination and brains not the spirit of a dead person. If there are any messages obtained while the medium is in a "trance," which are not fraud (this I greatly doubt), they could be the result of the subconscious mind. As to "ghosts," I entertain the same theory as with hallucinations—that it is due entirely to the person's imagination greatly aided by the "ghostly" surroundings. I believe that all written messages from the dead are also frauds, the same as "spirit-photography" and the like.

Will SCIENCE AND INVENTION please explain how a person can apparently "take off a thumb" which some spiritualists claim dead people's spirits have given them the power to do?

Why does not SCIENCE AND INVENTION publish a book of their Dunninger's, and Rinn's, etc., Spiritualistic Investigations? Another book that I am sure would be well appreciated is one containing all of the best tricks published in SCIENCE AND INVENTION Magazine. I, for one, like to obtain clippings on Magic and do not like to deface magazines to obtain them.

Giving my best wishes to this magazine for their fine work in exterminating those charlatans who claim to do the supernatural as in the case of mediums who claim to have a power with which to communicate with the dead, I wish this magazine and its helpers continued success.

ROLAND E. BURDICK,
De Ruyter, N. Y.

(We have not as yet seen any medium capable of "taking her thumb off." Some mediums might employ the thumb trick described in the first issue of "Popular Magic."

We may publish a book of Spiritualistic Investigations at some future date. Two books on the subject of Magic have already appeared. These are available directly from your local news agent. The name of the books is "Popular Magic," volumes one and two. The first contains tricks by Mr. Dunninger and various other authors and the second was written exclusively by Mr. Dunninger. The books are of the same size as this magazine and contain 112 and 96 pages respectively. It would be wise for you to get both of them if you are interested in Magic.

We do not assume that the average medium is suffering from hallucinations. The term hallucination is generally applied to a disorder of the nervous system, in which objects which have no reality are perceived. But you yourself can close your eyes and recall the visions of perhaps a scene down by the village brook in the summer time when you enjoyed yourself, swimming in a shallow pool, or you might likewise recall some event in your childhood school day life, in which the mental vision appears quite real. This cannot be classed as hallucination.

Automatic writings are of course the result of subconscious action or at least that is our assumption.—EDITOR.)

AMAZING STORIES

IN OUR SEPTEMBER ISSUE:

THE RADIO GHOST, by Otis Adelbert Kline. You can not fail to remember "The Malignant Entity," by this well-known author. Here he has outdone himself in an original story, never published before, which shows you all of the wonders of radio when used for malignant purposes; a story so thrilling, yet so pregnant with possibilities, that you shudder to think that the same instrumentalities which we actually have today might be put to use by some one with a criminal mentality.

THE MALIGNANT FLOWER, by Anthos. This story, which has just come to us from Germany, is a little literary masterpiece and scientific gem. There are many flowers and plants that catch not only flies and other insects, but small mammals as well. There is, therefore, no reason to doubt the existence of such plants. This story is so unusual and so excellently told, that we have no hesitancy in calling your particular attention to it.

THE STONE CAT, by Miles J. Breuer, M.D. "but this (Lot's) wife looked back from behind him, and she became a pillar of salt." Thus reads the Bible (Genesis xix:26). In reading this story by the author of "The Man with the Strange Head," you will instinctively think of petrified forests and prehistoric animals, many of which can be found in our national museums. We simply mention this to show that the idea of petrifying human beings is, after all, not so far-fetched.

THE WAR OF THE WORLDS, by H. G. Wells. In the second installment we find the Martians in possession of the earth. By means of their superior intelligence and their death-dealing war implements, they have thoroughly subjugated everybody. The author describes graphically what might happen on earth should any nation be able to acquire such power. You will read with intense interest the concluding part of this great scientifiction story.

And many other new stories of unusual interest.

A BRICKBAT

Editor, SCIENCE AND INVENTION:

Just a hint or two from an old reader. I agree with G. Nazaretian's letter of the March issue. You claim you publish new stuff. Evidently you have a poor filing or indexing system. Take, for example, the October, 1925, issue, page 533, and the March, 1927, issue, page 1028. You have an article in each of these issues showing how to insulate a pair of pliers with a piece of rubber tubing. The only difference I can see in both these articles is the wording of same. Now here is where the rub comes in. The average experimenter has no rubber tubing. It comes in different sizes and is quite expensive and it is not easily obtainable. So he uses rubber tape which, in my opinion, is much safer and affords a much better grip due to the overlapping edges of the tape.

And another howl about this fiction story problem. I've read SCIENCE AND INVENTION and the EXPERIMENTER for many a moon, but have never read one of its serial stories and never will. I'll admit that Mr. Cummings is quite a clever writer and that his stories require quite some brain work on his part. The only fiction I ever read were short stories. (Dr. Hackensaw's Secrets and others.) I would like to see the short stories published in preference to the serial type of story. But please do not publish both and so waste a lot of valuable space.

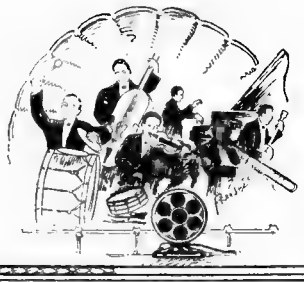
Wirekraft and Matchcraft is not so hot. The results are crude and not ornamental. The Model Department is O. K. Why not publish plans and specifications of some of the models that have won cups?

F. A. JUSAITES.

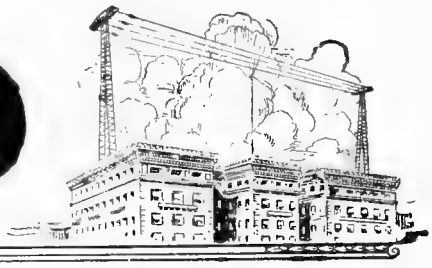
(Rubber tubing can ordinarily be procured in any drug-store as well as in any rubber store. Contrary to your statement, it is not expensive. As a matter of fact, rubber tubing is considerably cheaper than rubber tape. Your suggestion for the use of rubber tape as a means for insulating the handles of a pliers is practical and we are glad to pass it along to our readers.

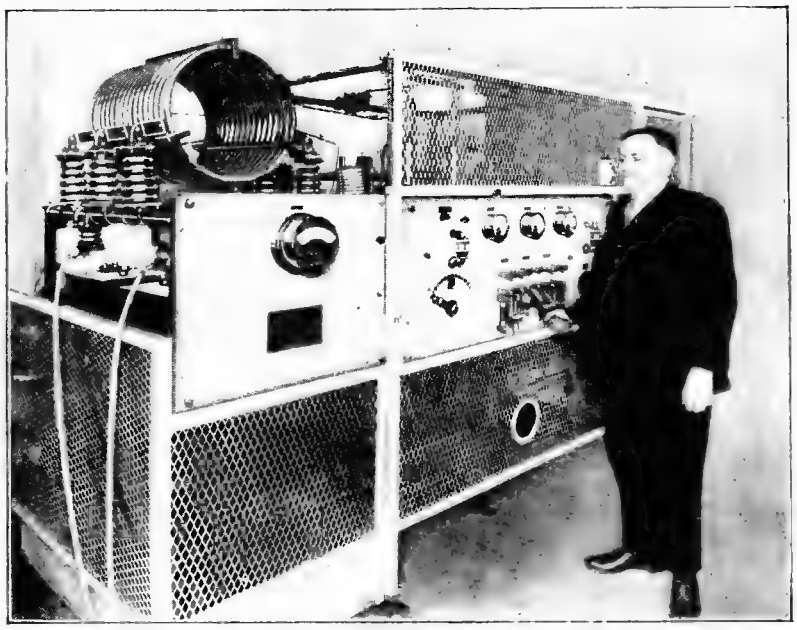
You will note that SCIENCE AND INVENTION magazine has discontinued the serial fiction stories for the present. The short stories now appearing are by different authors. The Matchcraft Department is also discontinued. Again we would advise that you have evidently paid very little attention to some of the Matchcraft constructions. Most of them are remarkably beautiful and ornamental. We hope that Wirekrafters will take a tip from Matchcrafters and improve their constructions.

(Continued on page 464)



RADIO





The high frequency generator used in the Westinghouse Laboratories, is shown in the photograph at the left. Dr. Rentschler, research engineer of the Westinghouse Lamp Co., appears at the control panel.

The "Radio" Furnace

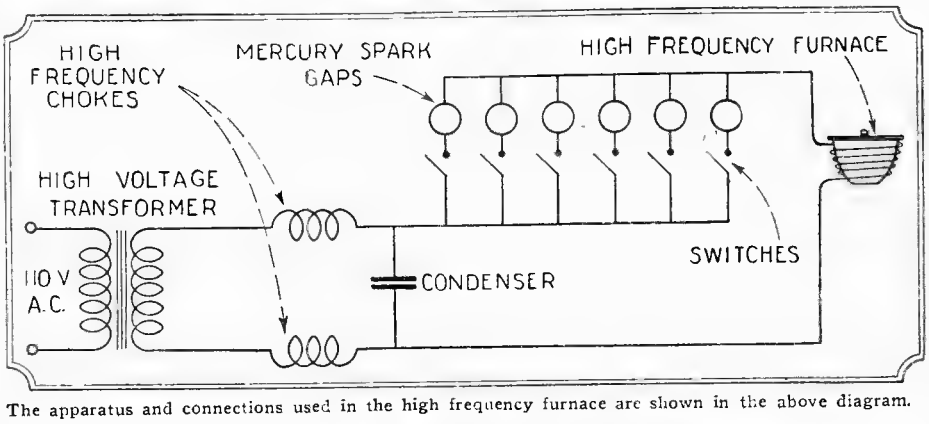
Invisible Rays Produce Intense Heat

AT a recent meeting of the New York Electrical Society, Dr. Rentschler, research engineer of the Westinghouse Lamp Company demonstrated the principles of his "radio" or high frequency furnace. A disk of metallic tungsten, among the most infusible of all metals, was heated white hot in an instant by the invisible rays. Chemical reactions, hitherto only possible in a vacuum, were initiated by radio waves. The furnace is designed to concentrate large amounts of radio power within a small space.

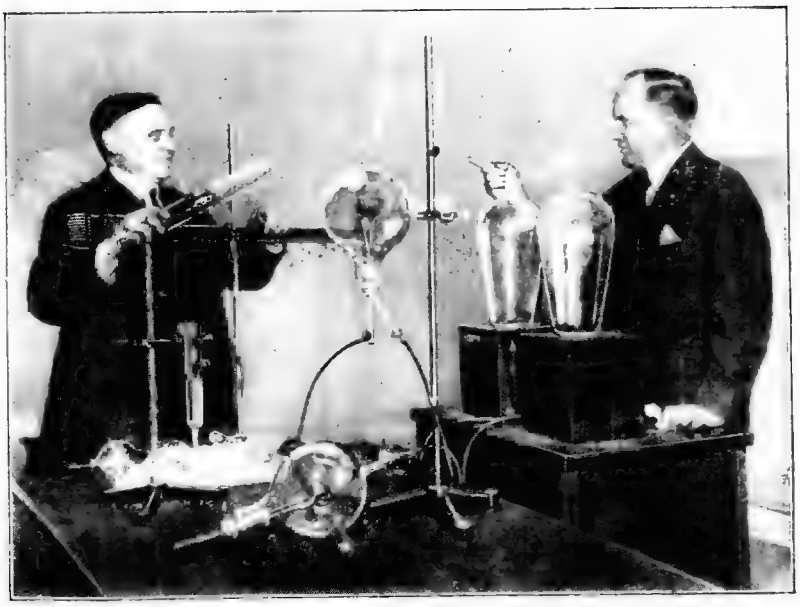
Certain metals, although well known to chemists, cannot be prepared usefully in metallic form by ordinary methods, because these metals are combustible when in fine powder, oxidizing rapidly in the air whenever they are heated. By conducting the heating of these remarkable inflammable metals with radio power and in a vacuum, Dr. Rentschler has made them in metallic form and in some quantity. Two of these metals, thorium and uranium, belong to the group of radioactive metals, which includes radium. Now that the use of the vacuum furnace has made these particular metals available, they are expected to find uses in industry.

Another use of the "radio" furnace is to turn metals like gold and silver into gases, so that their individual atoms can be weighed and studied. These metallic atoms are so tiny that more than ten thousand billion billions of them are necessary to make one ounce. Some of them are capable of existing in free condition only for ten thousandths of a second or less. Nevertheless, the high frequency furnace permits them to be studied and weighed with results of important value, to atomic science.

A high frequency current, derived from a high-voltage transformer, is passed through suitable chokes and a condenser to the spark gaps and then to the high frequency coil, which constitutes the furnace. In the experiments carried out at the Westinghouse Laboratories, six mercury spark gaps were used. These gaps were connected in parallel so that the amount of current delivered to the furnace might be controlled by throwing a switch, connecting or disconnecting one or more of the gaps. An evacuated bulb containing a small amount of potassium in metallic form was placed within the high frequency furnace and in a few moments became coated with the silvery metal. The demonstration was carried on in a totally dark room and was spectacular to say the least. The high frequency coil used in the above experiment was not placed within a vacuum but was simply in the open air. A portable high frequency generator was used.



The apparatus and connections used in the high frequency furnace are shown in the above diagram.



Dr. Rentschler is shown at the right demonstrating the principles of his high-frequency furnace. The mercury spark gaps, two of which were used in the demonstration, may be seen at the extreme right of the photograph. Three of the novel furnaces may also be seen, two have been placed in evacuated glass bulbs and the other appears above Dr. Rentschler's right hand. (Note the small portable high frequency generator on top of which the mercury gaps are placed.)

A Compact 3-Tube

Light Weight and Simple Design Make

By HERBERT

The completed portable set is shown above, ready to be taken to the country. The small size of the receiver may be judged from the photograph.

NOW that vacation time is with us again, the radio fan will want a set that he can take away with him. One that will tuck away in a corner if need be, and be ready to operate the minute the case is opened. If the directions given in this article are carried out, the builder will find that, with a few tools, it is easy to construct this three tube set, all in a small week-end case, measuring 14" long by 9¼" wide, and 5" deep. A case of this sort costs about two dollars at most stores. If the dimensions are a little larger than those given the set will work the same, but the builder should not try to crowd the parts into a smaller housing.

USES BOX LOOP AERIAL

The feature of the set is the box loop, which is made on a frame of thin cardboard using Litz wire. The frame is 13¼" high, 8½" wide, and 1¼" deep. By spacing the turns correctly, it is possible to wind 18 turns of stranded or Litz wire, tapping the winding at the center, or ninth turn. Allow about one foot of wire for each lead for the necessary connections. The finished loop is then placed in the cover of the case and held down with several strips of adhesive tape.

THE PANEL

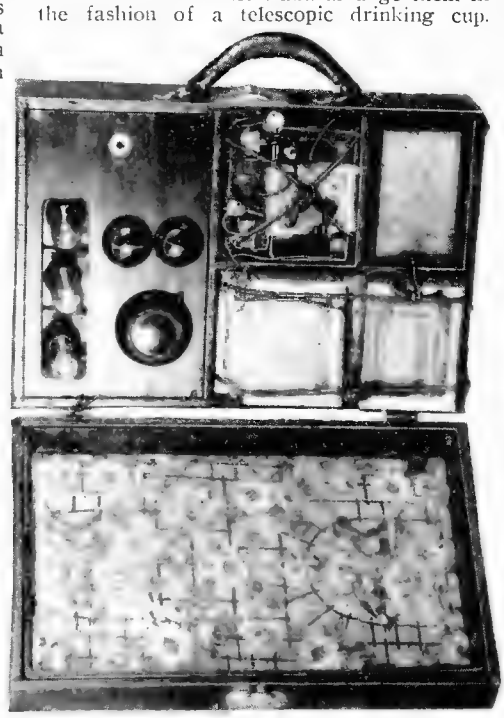
Next cut out the panel. Bakelite, hard rubber or Celoron can be used, but for our purpose three ply wood will do just as well. Notice that the panel has been cut away to allow for insertion of three 199 type tubes. The panel is easily cut out. Mark off the lines as given in the drawing, drill a small hole, and then using a jeweler's saw, cut out this strip. The resultant neat, even edges are not the ragged result that would be obtained if other home-made methods were used. The sides of the panel should be drilled with mounting holes, but it will not be found necessary to place screws on the top and bottom also. Therefore, glue two sticks, one on each side of the case, to match up with the holes, so that the wood screws can be inserted when all of the apparatus has been mounted on the panel. The drawing gives the proper location of the various instruments which are to be mounted on the front panel.

USE SHOCK-PROOF SOCKETS

The cushion sockets are mounted in the case on a small baseboard, the same size as the front panel, and placed right under the cut-out space on the panel. In this manner they ride along when the set is being carried, and do away with hum and tube noise. The two audio-frequency transformers are also mounted upon this board.

There is no magic about the set or the circuit. It is just the first part of a standard super-heterodyne, with all the selectivity, less the extreme D. X. powers of the big 8-tube super. The two stages of audio amplification will provide sufficient volume to operate the small speaker, which is about as large as a tea cup. It may be well to try a number of different units until the best one is found which suits the builder's requirements.

If the builder so desires, he may make a folding loud speaker to go with his portable receiver. These loud speakers can be made of cardboard or some thin metal, and fold up similar to the bellows on a camera. Another good idea is to construct four or five circular bands of metal and arrange them in the fashion of a telescopic drinking cup.



A view of the completed set with the cover thrown back is shown in the photograph above. Note that the "B" and "C" batteries have been tied in place with ordinary shoe laces.

These loud speakers take up relatively little room, and yet are quite efficient.

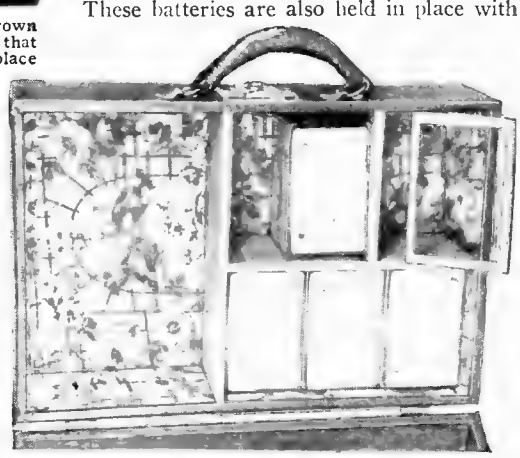
SINGLE DIAL TUNING FEATURE

The main tuning condenser, in fact the only tuning control, is the variable condenser of .0005 microfarad capacity. The small condenser of .00005 microfarad capacity is used to control regeneration, and may be left in a more or less permanent position. It can be adjusted for most stations on an average setting, and left there, the real tuning being accomplished with the twin-rotor condenser, so that it is really a one dial set. The standard dial will not fit in this particular set, since there is not room enough. A standard bakelite or hard rubber knob is substituted instead, and the stations recorded directly on the panel with white pencil or white ink. This makes it possible to turn the dial directly to the station wanted.

INSTALLING "B" BATTERIES

The installation of the "B" batteries is quite simple. The case is divided off with one quarter inch wood, as shown in the photograph. First, place a strip from the bottom of the case righ up flush with the top. This holds the bottom of the panel in place. The center strip is placed 4½" from the side on which the handle is mounted, and serves as a separator for the batteries. Perpendicular to this another small strip is arranged, which forms the top of the compartment used for the loud speaker. Three "B" batteries are placed in the compartment to the left (under the panel), and three "C" batteries are placed over these. The "C" batteries are used, in this instance, as "A" batteries. In the right hand compartment one "B" battery and one "C" battery are placed, and directly under these, the small speaker or speaker unit. The appearance of the set will be considerably enhanced if the speaker compartment is covered with a small piece of silk stretched over a frame and fitted in properly, as shown. After the batteries have been stacked up, you will find that a piece of cord looped from top to bottom and over these batteries, will hold them all in place when properly tied. It is a good plan to provide a small jack connection as shown, since this allows for the insertion of head-phones, when desirable. The necessary battery connections are brought out in the usual manner with flexible wires, attaching to each one a metal battery tag.

If you have carried out the plans carefully you will find that it is possible to place three "B" batteries on top of each other, binding posts facing you in the space to the left underneath the panel and after placing a piece of cardboard over all of these posts to place on top of this assembly two "C" batteries which in this case are used as "A" batteries. In the right-hand section under the panel, just enough room will be found for the insertion of another "B" battery, posts facing outward, and another "C" battery, posts also facing out. Then on top of both these batteries, and in the cardboard case in which it is supplied, a three cell flashlight battery is placed, which is used as a "C" battery. These batteries are also held in place with



An interior view of the cabinet is shown at the right. Note the placement of the "B" battery and the loud speaker compartments. The cabinet has been lined with cretonne.

Portable Receiver

This Set an Ideal Vacation Companion

E. HAYDEN

a piece of wrapping cord. Now, in the bottom section, which is scarcely larger than your fist, the loud speaker is installed and the wires suitably brought up to the panel for the purpose of connections. At first glance this will probably seem impossible, since the space is so small, but a small unit will just fit in this compartment.

MOUNTING THE APPARATUS

In connecting the apparatus, it will be found best to mount the sockets first on the baseboard, getting them in line with the panel cut-out section, so that the tubes will be in line. The two audio-frequency transformers should be placed at right angles at the extreme right-hand side of the baseboard. Do not mount them too close together, for aside from the magnetic feed-back to be expected, you will not have enough room for the small jack on the panel, which normally fits in between the two transformers. All of the necessary connections to the sockets and transformers should now be completed, using bus bar wire for the purpose and soldering every connection. Then drill two holes through the baseboard and the cabinet, fitting two 3/16 machine screws through these holes, screw heads on the outside and tighten up on the baseboard with suitable nuts so as to hold this assembly fast to the case.

Next mount the apparatus specified on the panel, connecting this where possible with bus bar and the connections that necessarily lead to the baseboard with flexible insulated wire, so that you can check everything before screwing the panel in place. Before testing the receiver check all wiring to make sure that no mistakes have been made. Insert the tubes in the sockets and connect the "A" battery to the "B" battery terminals. If the tubes light when the "A" battery is connected in this manner it indicates that a short circuit exists between the "A" and "B" batteries.

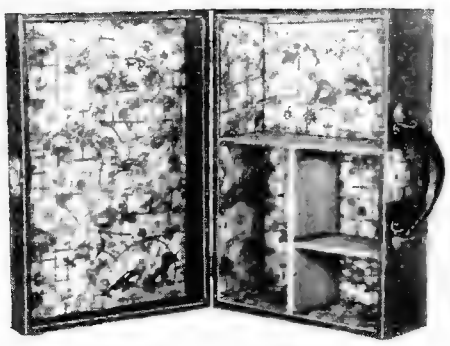
BUILDING YOUR OWN CARRYING CASE

If the builder thinks that the cost of the set would be prohibitve, he may build his own carrying case. If care is exercised in its construction, there is no reason why a very neat job should not result. The case is best made of some soft ply wood, cut to the dimensions shown in the diagrams. All corners should be carefully glued and afterwards secured with screws. The pieces to be glued should be allowed to set over night in some out of the way place so that there will be no danger of them moving. It is well to place a heavy weight upon them in order to allow the glue to set better. After the case has been completed, it may be covered with oil cloth or leatherette. This should be glued fast and it is well to cover the corners with small brass caps. If the builder wishes, he may use a larger size cabinet so that his folding loud speaker may be incorporated with the set.

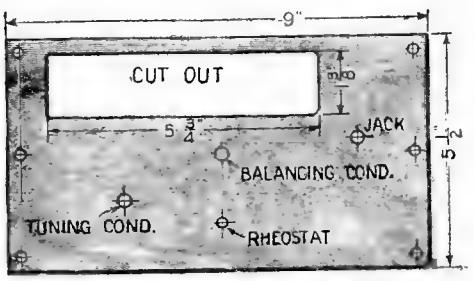
If you carry out the construction as suggested, you will have a very fine portable receiver with volume enough for a small room with the little speaker, or if desired, on occasion, the use of head phones through the agency of the panel jack. The receiver is entirely self-contained. All of the necessary apparatus which includes the receiver proper, all batteries and loud speaker have been included. It has been tested under some poor conditions, in the center of steel buildings, down in the subway, and in other places where one would not expect it to work at all, but it has performed very well. It is really very easy to operate. One simply opens the case, stands it up on end, turns on the rheostat, swings the loop a little and sits back to enjoy the program. The set should be a great companion for week-end trips or for the baseball scores in your office during the summer months.

It is easy to carry and also easy to operate. Do not treat it roughly.

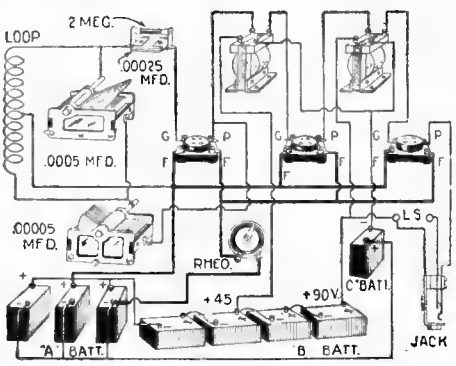
Above the receiver is shown in operation. It is practically a one dial control set as most of the tuning is done with the large variable condenser.



Another interior view of the set, with the panel removed, is shown in the above photograph. The battery and loud speaker compartments are constructed from one-quarter inch soft wood. The loud speaker compartment is placed in the lower right hand side of the cabinet and battery compartments above and to the left of the speaker.



The front panel layout is shown above. Note that a section has been cut out to allow for the projection of the three tubes. The panel itself is small, measuring but nine by five and one-half inches.



A picture diagram of the necessary connections is given above. The simplicity of the circuit makes it ideal for portable use and should appeal to all radio constructors.

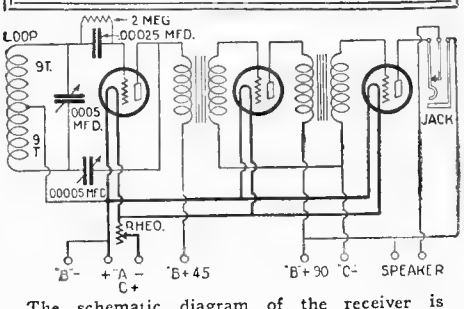
LIST OF PARTS

3 UX 199 type tubes.
3 cushion sockets.
1 3"dial.
1 small jack.
1 30-ohm midget rheostat.
2 6-1 ratio audio-frequency transformers.
1 .00025 mfd. fixed condenser.
1 2-megohm grid leak.
1 .00005 mfd. balancing condenser.
1 .0005 mfd. twin-rotor variable condenser.
1 small loud speaker.
4 "B" batteries.
3 "C" batteries.
1 flashlight battery.
1 package battery tags.
1 package flexible hook-up wire.
1 can of glue.
Necesary wire for loop, screws, etc.

Names of manufacturers of parts supplied upon request.

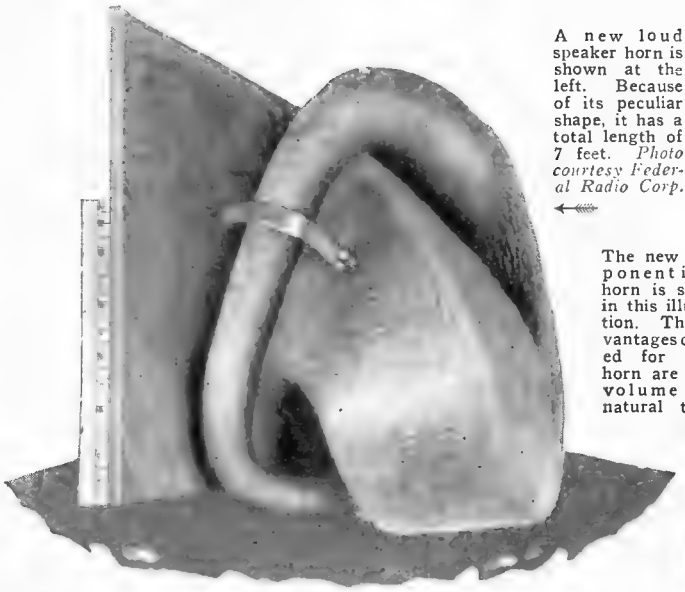
TOOL LIST

Pliers, several kinds.
Screw drivers, several sizes.
Hammer, hacksaw and blades.
Hand drill.
Twist drills, several sizes.
Scriber.
Center-punch.
Soldering iron, electric or other type.
Wire solder, self-fluxing or plain solder and non-corrosive flux.
Rule, steel or wood.
Center finder for dials.
1 three or four cornered reamer and handle for expanding panel holes for shafts, jacks, etc.
1 Jeweler's saw.
Small tool and awl handle very useful.
Volt and ammeters for testing set, batteries, etc.
1 Countersink.
1 Adjustable template.

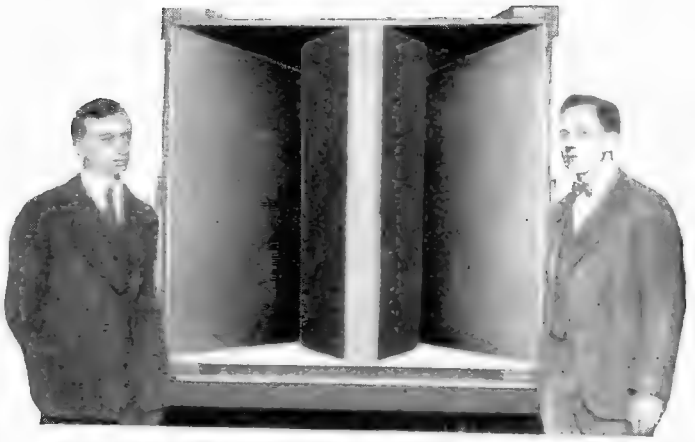


The schematic diagram of the receiver is shown here. Note that the loop has been tapped at the ninth turn and that the tap itself is connected to the A-plus.

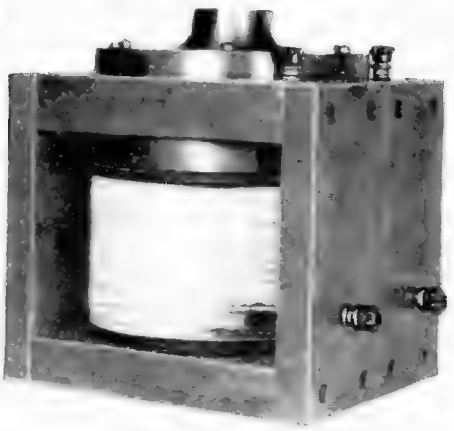
Recent Loud Speaker Developments



A new loud speaker horn is shown at the left. Because of its peculiar shape, it has a total length of 7 feet. *Photo courtesy Federal Radio Corp.*



The new "Exponential" horn is shown in this illustration. The advantages claimed for this horn are great volume and natural tone.



The unit used in the new "Exponential" loud speaker is shown in this illustration. It is remarkable how much volume is obtained with this horn, with no more power than the ordinary speaker requires. The unit shown is of the moving coil type, but any good unit would serve the purpose.

A NEW invention called the "Exponential" horn, which is said to broadcast the natural human voice or tones of musical instruments without distortion for the greater part of a mile, received its first public test recently. Engineers, music critics, and newspaper representatives were present at the demonstration, and were surprised at the results. The secret of the horn's volume lies in a mathematically precise enlargement of the tone chamber.

THERE are two factions working on the new development of distortionless loud speakers at present. One of these factions uses the principle of a large diaphragm. This is the well known cone shaped loud speaker. The other faction working on the development of loud speakers uses a small diaphragm, and a very long horn. An example of this type of horn is the exponential phonograph horn. Recent developments in the radio line have resulted in horns 7 feet long or more, shaped so that they will not take up too much space. The horn in the illustration above measures 24 inches long and 19 inches high. It tapers quite regularly from the mouth to the small end.

HIGH SPEED TUBE TESTER

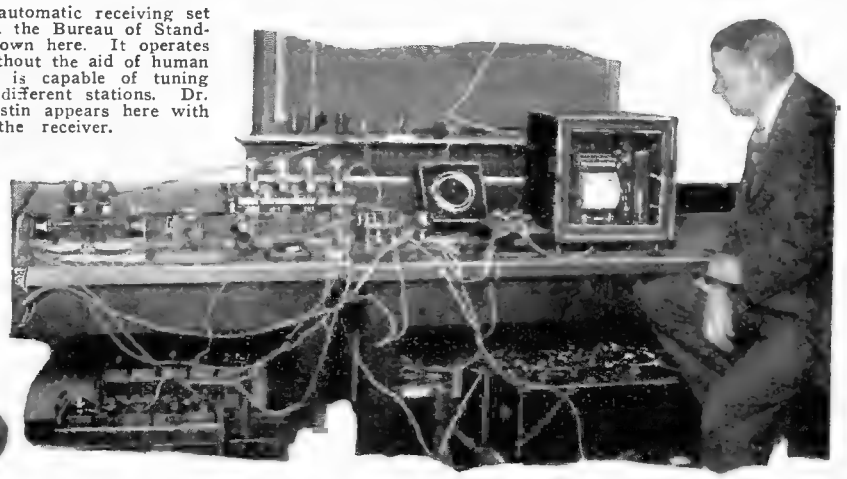
IN the manufacture of radio tubes, one of the most important operations is the final electric test to reject the inoperative tubes, and those that are not satisfactory for set operation. The time required to do this by hand is considerable. A new machine has recently been developed to do this automatically. The machine consists of several test circuits and an electrical control board, connected to mechanical apparatus, which connects the tubes in succession to the various circuits. A mechanical device conveys the rejected tubes away from the machine.

The new high speed automatic tube tester is shown in action below. This tester rejects any tubes that have broken filaments, poor oscillation or leaks.

Photo courtesy Westinghouse Lamp Co.

AUTOMATIC RECEIVER

The new automatic receiving set installed in the Bureau of Standards, is shown here. It operates entirely without the aid of human hands and is capable of tuning in twelve different stations. Dr. L. W. Austin appears here with the receiver.



THE Special Radio Research Laboratory of the Bureau of Standards has recently designed and put into operation the only automatic receiving set in the world. It operates without any human aid and is capable of tuning in twelve different stations, some of which are European. The illustration above shows Dr. L. W. Austin, head of the Special Radio Transmission Research Laboratory, inspecting the apparatus as it has been set up in one of the laboratories of the Bureau of Standards. This receiver is a good example of the remarkable work that has been done by this department of the United States Government. Dr. Austin is one of the leading authorities on static in this country and has recently plotted graphs of the comparison of static strength to thunder storms. These graphs show that there is a direct relation between static and thunder storms.

RADIO ORACLE

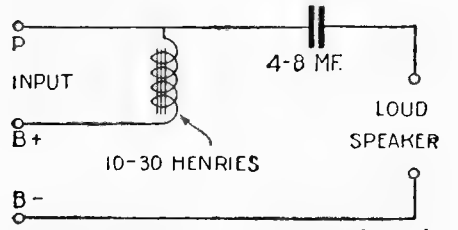
In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

LOUD SPEAKER COUPLING

(568) F. Martin, White Plains, New York, writes as follows:

Q. 1. I am using a UX-171 tube in the second audio stage with 180 volts on the plate. What is the best method for coupling the loud speaker to the set under these conditions?

A. 1. What is known as the choke and condenser method of coupling invariably works best in this case. The choke coil should have an inductance of 10 to 30 henries and should not exceed 1,000 ohms D.C. resistance. The fixed condenser should have a capacity of 4 to 8 microfarads. By referring to the diagram appearing on this page you will readily see the necessary connections for this type of coupling.



The connections for choke coil loud speaker coupling are shown above.

POWER TUBE USAGE

(569) J. Dunlap, Marquette, Wisconsin, writes:

Q. 1. In my present set, which I wish to modernize, I am using a UX-201-A tube in the detector socket and a UX-112 in the first audio stage. The other tubes are UV-201-A's. What improvement in the tube arrangement or type can you suggest?

A. 1. The UX-112 tube is designated as a power amplifier tube for the output stage only. The other tubes as used are correct.

Q. 2. What changes must be made to employ a 135-volt plate battery instead of the 90-volt battery I now use?

A.2. None, if the set is designed to employ 135 volts on the output stage and a tube that requires that plate voltage is used. However, do not forget that an output tube also requires a certain C battery voltage.

ADDING R. F. AMPLIFICATION

(570) E. W. Burwon, Houston, Texas, writes:

Q. 1. Several months ago I built a three-tube receiver employing a regenerative detector and two stages of transformer coupled audio. The Hartley system is used in the detector. I would like to add a stage of tuned radio frequency amplification. Could this be done? The primary coil consists of fifteeen turns and the secondary of sixty-two turns. Both are wound on the same form and the secondary is tapped at the thirty-first turn. A .0005 mfd. variable condenser is shunted across the entire secondary winding.

A. 1. Radio frequency amplification may be added to your present receiver by using the following: Wind a fifteeen-turn primary and a sixty-two-turn secondary on 2½-inch tubing, separating them ¼ inch, using No. 22 D. C. C. wire. The winding should not be tapped and should be shunted by a .0005 mfd. variable condenser.

REJUVENATING STORAGE BATTERIES

(571) S. T. Virtue, Deposit, New York, writes:

Q. 1. I have a lead-acid storage battery which has been giving me excellent service for three years; recently, however, the battery has seemed to lose its ampere hour capacity and is unable to deliver or take an appreciable charge. Can you help me in this matter and possibly suggest a remedy?

A. 1. Storage batteries sometimes lose their capacity because the active material has fallen from the plates. This effect will be disclosed by the inability of the battery to deliver or take a charge. The remedy is to replace the worn-out plates with new ones. A hopeless case is the short-circuited cell of a storage battery. Sometimes the material that has fallen off the plates piles up under them and short circuits them, thus causing one or more of the cells to lose its voltage or to lose its charge rapidly. Occasionally a battery which has no short-circuited cells, or does not lose its charge, cannot be charged to the usual specific gravity. Sometimes batteries in this condition can be revived. The following treatment can be used where the plates of a cell are still in good condition but have become sulphated and hardened. All the acid, in the first place, must be taken out of the cell. New acid is then added and the battery charged. At first, the battery must be charged slowly. When the specific gravity has reached its maximum value, the charging of the battery should be stopped and all the acid should be drained from the cells. Then they may be refilled with distilled water and the battery discharged through a six ohm resistance which is placed across the terminals. This discharging operation will require about 24 to 36 hours. After discharging, the battery should again be charged for about 12 hours at not over 10 amperes and then the charging should be continued at a much slower rate for about 15 to 24 hours more for the purpose of removing any excess of acid from the plates and to take the sulphate deposits from them. This process should be repeated at least twice and possibly three times, removing all the water remaining in the cells and refilling them with fresh distilled water. After this the cells may be filled with a new acid solution which should have a specific gravity of 1.200 or 1.250. As soon as the new acid solution has been put into the cells the gravity of the electrolyte drops to some extent, due to absorption by the plates. The gravity rises again as soon as the battery is charged. The charge should be continued until the gravity test is nearly up to the value stated above. The cells of the battery are then ready for service.

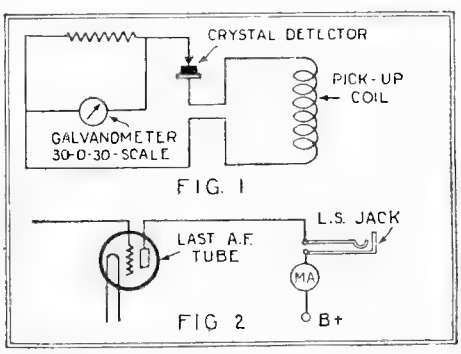
OSCILLATION AND BIAS TEST

(572) A. R. Andrews, Albany, N. Y., writes:

Q. 1. Can you give me a simple test for oscillation and for proper grid bias regulation on the last audio tube?

A. 1. For the convenience of those who may find it necessary to frequently test oscillators, a device, the circuit for which is shown on this page, will be described. The tester consists merely of a galvanometer, a shunt resistance, a rectifying device and a pick-up coil. It can be used to determine whether or not the oscillator is functioning properly. The set should be turned on and the pick-up coil of the tester loosely coupled to the oscillator coil in the receiver. The galvanometer should show a reasonable deflection over the entire range of rotation of the oscillator dial. The pick-up coil of the tester can be of any convenient size and number of turns; 15 or 20 turns will suffice. A milliammeter with a maximum reading of less than 10 milliamperes or a high-grade, sensitive voltmeter can be substituted for the galvanometer if desired.

It is possible to determine by means of a direct current milliammeter, having a full scale reading from 10 to 25 milliamperes, the correct value of "C" battery voltage to use on the last audio tube. The milliammeter should be connected in series with the plate circuit of this tube as shown in the diagram, Fig. 2. The "C" battery should be varied in steps of about one-half volt until the deflection of the milliammeter pointer about its normal mean position is zero or is very small while the signal is being received. If the milliammeter pointer kicks upward, the grid bias is too low and if it kicks downward, the grid bias is too high. If it is found impossible to adjust the "C" battery so that the pointer is steady, the plate voltage should be raised and the "C" battery again adjusted as before. If the plate voltage previously used was the maximum specified by the tube manufacturer, a tube having a greater power output should be used.



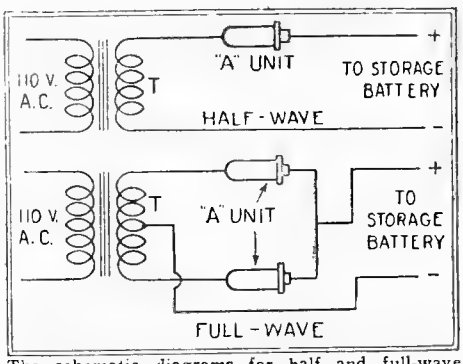
The hook-up and apparatus used for the oscillation and proper bias tests appear in the above diagrams.

CARTRIDGE RECTIFIER

(573) H. Erickson, Miami Beach, Fla., writes:

Q. 1. Will you publish the diagrams showing how the Raytheon "A" rectifier cartridge can be used as a half and full-wave rectifier for charging storage batteries. Upon what principle do these units work?

A. 1. The Raytheon "A" unit affords a unidirectional conduction without attention of any kind. Rectification is secured by the close association of two metallic conductors suitably arranged with a non-conducting agent, which combination serves to reduce the resistance to the flow of current in one direction, while the resistance to the flow of current in the reverse direction is extremely high. On this page you will find illustrated the schematic diagrams for half-wave and full-wave rectification, using the cartridge rectifiers. The small end or pin of the cartridge is the cathode, and should be connected to the positive side of the output circuit, while the body is the anode, and should be connected through the transformer secondary to the negative side of the output circuit. The transformer may be of any type giving suitable regulation and secondary voltage. The secondary voltage should be approximately nine volts under no-load conditions, with the transformer connected to a standard 110-volt lighting circuit. A variation of line voltage of from 105 to 115 should not vary the secondary voltage to such an extent that it will rise higher than 9.5 or drop lower than 8.5 volts. Under no circumstances should the design and regulation be such that a current flow greater than 2.5 amperes can take place with a line voltage of 120 applied to the primary. If a charging rate higher than the full 2.5 amperes is desired, it may be obtained by using two of the "A" rectifier cartridges, or the full-wave double "A" Raytheon, with a full-wave transformer. A charging rate of four to five amperes may be easily and economically obtained by this means.



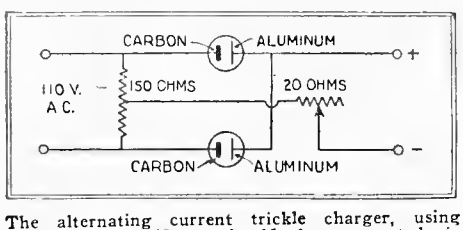
The schematic diagrams for half and full-wave rectifiers using the Raytheon "A" units are shown above.

A. C. TRICKLE CHARGER

(574) G. Larsen, Pittsburgh, Pa., asks:

Q. 1. Can you give me the necessary information for the construction of a simple alternating current trickle charger?

A. 1. The connections for a charger that will charge the battery at a rate from 0.3 to 0.6 ampere are shown on this page. The center tapped shunt resistance should be rated at about 150 ohms. The rheostat is a 20 ohm field rheostat. The rectifying elements are composed of carbon and aluminum rods 3/16th inch in diameter and about 2 inches long, separated by about ¼ inch. The electrolyte used is a saturated solution of ammonium phosphate which contains a small percentage of potassium phosphate. Ordinary quart preserve jars may be used for the rectifier cells. The trickle charger has met with the approval of many radio fans who find that it charges batteries with a minimum of trouble. The cost of operation of this particular charger is low, and the only replacement necessary will be the aluminum electrodes. These will have to be replaced about once every six months. A simple method for getting contact on the elements is to drill and tap a 3/16 hole and then tightly screw in a long 3/16 stud which can be attached to a rubber strip running across the mouth of the jar. There are several other electrolytes that can be used with this rectifier besides ammonium phosphate. Ordinary "20 Mule Team" Borax is often used and is entirely satisfactory. This solution should be a saturated one. This may be accomplished by warming distilled water slightly and adding borax until no more will dissolve. The solution should be allowed to cool and the precipitate filtered. Mineral oil poured on the electrolyte will prevent evaporating to some extent. Pure mineral oil should be used for this purpose as animal oils will react with the electrolyte and prevent the charger from working.



The alternating current trickle charger, using electrolytic rectifiers, should be connected in accordance with the above diagram. Note connections to rectifier cells.

Scientific Humor

TOO-TRUE

LECTURER: "Can anyone give the derivation of the word auditorium?"

LISTENER: "Yes—from Audio—hear, and Taurus—bull, a place where you——"

LECTURER: "That will do."—*Joseph Wallace.*

TRANSLATED MEANING "ANYTHING"

At a Thanksgiving dinner, W. M. Evarts was asked what part of the turkey he preferred. He answered: "It is quite inconsequential to my recognized abstemiousness and supersensitive stomachic nervation whether I be tendered an infinitesimal portion of the opaque nutriment of the nether extremities, the superior fraction of a pinion, or the snowy cleavage from the cardiac region."—*Fritz Allikas.*

ACCORDING TO SCIENCE

BILL: "There is enough nicotine in one cigar to kill twenty cats."

BELL: "Fancy twenty cats smoking one cigar."—*L. F. Carpenter.*

AND THE SPRING MAKES THEM LEAVE

BILL: "What causes petrified trees?"

BELL: "The breeze makes them rock."

—*L. F. Carpenter.*

PERPETUAL MOTION

BIM: "It's a funny thing about my wife"—

BAM: "Yeah?"

BIM: "Yes, she gets all wound up when she starts to tell how run down she is!"

—*Henry A. Courtney.*

LIGHT ON THE SUBJECT

Two little urchins were watching a barber singe his customer's hair.

"Gee," said one, "he is hunting 'em with a light."

—*Joseph Wallace*

AN UNDER OVERSIGHT

ABSENT-MINDED PROFESSOR (as he notices a jar sitting upsidedown on the laboratory desk): "Why this is a funny jar. It hasn't any neck. (Then as he picks it up and turns it over:) Well it certainly is a queer jar. It hasn't any bottom either."—*Walter M. Egel.*

First Prize $3.00

SHE WAS QUITE OUT

COON: "Look how high that ship is floating out of the water."

LOON: "Oh, didn't you know, dear, it's low-tide just now."—*C. H. Frazer.*

SHE READ S. & I.

HE: "Do you believe there are 40,000 germs in every kiss?"

SHE: "I've never——"

HE: "Never been kissed?"

SHE: "No, never been sick."—*Leslie Carpenter.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

STARS IN CLASS

"D'ja hear about Smith getting kicked out of school for cheating in the astronomy exam?"

"No, was he?"

"Yes, he got the fellow in back of him to hit him on the head."—*M. R. Bercovitch, Rep. No.* 21,358.

BUTTON—BUTTON

WIFE: "I've just been reading an article on electricity, and it seems that before long we shall be able to get nearly everything we want by just touching a button."

HUSBAND: "You'll never be able to get anything that way."

WIFE: "Why not, John?"

HUSBAND: "Because nothing on earth would ever make you touch a button. Look at my shirt!"—*Mildred Leedy.*

NOW YOU "SPRING" ONE

The escapement wheel spoke to the hands on the clock:

"What are you doing?"

"Oh, we're just taking our daily dozen!" was the striking reply.—*Ruth E. Millard.*

SOME WRITER

SWEET YOUNG THING: "Mac, for heaven's sakes, how in the world did you ever get all that ink all over yourself?"

MAC: "S h h h, shh, not so loud, I was writing a theme about automobiles and it was so realistic that my fountain pen backfired."—*Henry Gombeyski.*

ALWAYS KEEPS IT ON HAND

"Had your iron today?"

"Yes, I chew my nails."—*Ruth E. Millard.*

USE SLIP-RINGS

The terminals of storage batteries should be coated well with vaseline—it allows the current to slip out easier.—*Ernest Rinn, Rep. No.* 11908.

WE'LL HIRE HIM

SYMPATHETIC OLD LADY (approaching newsboy on stormy night): "Aren't you afraid you will catch cold on such a night as this, my boy?"

S. & I. NEWSBOY: "Naw—selling magazines keeps up the circulation."—*H. Rowe.*

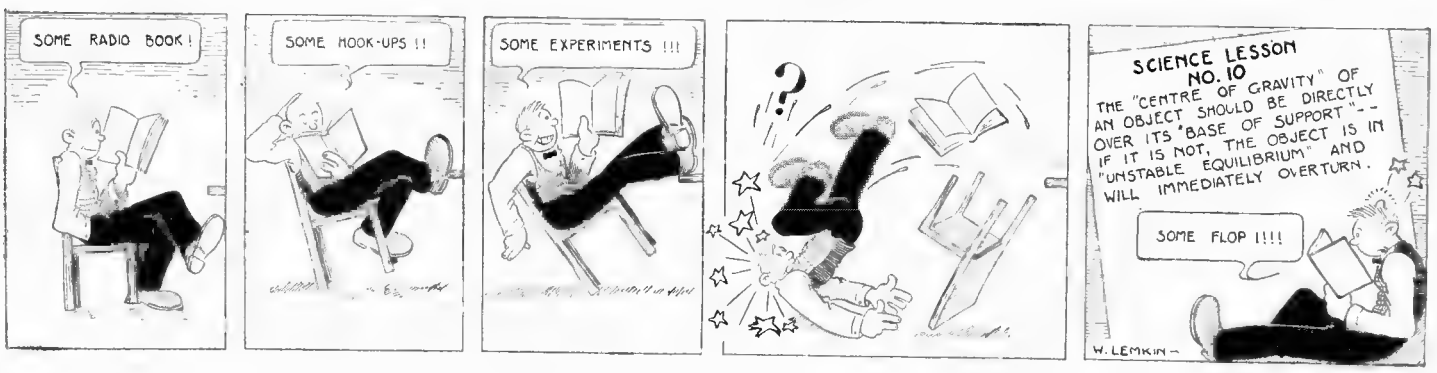
WE'LL TRY THIS ON OUR REED-ERS

MR. A. U. DIO: "To what botanical species does a Dee-Exer belong?"

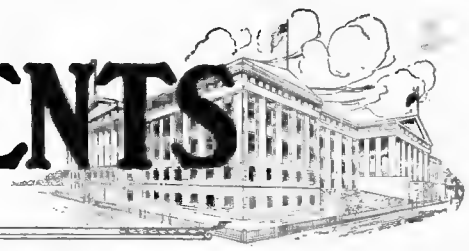
MR. R. A. DIO: "He is a dandy-lyin' pest."

—*Norman I. Schiller.*

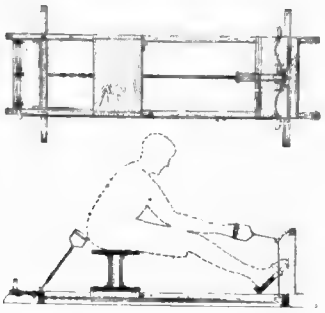
SCIENTY SIMON, SCIENTIST


SOME RADIO BOOK!
SOME HOOK-UPS !!
SOME EXPERIMENTS !!!
SCIENCE LESSON NO. 10
THE "CENTRE OF GRAVITY" OF AN OBJECT SHOULD BE DIRECTLY OVER ITS "BASE OF SUPPORT" -- IF IT IS NOT, THE OBJECT IS IN "UNSTABLE EQUILIBRIUM" AND WILL IMMEDIATELY OVERTURN.
SOME FLOP !!!!
W. LEMKIN

LATEST PATENTS

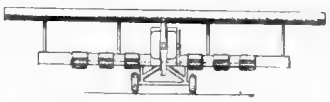


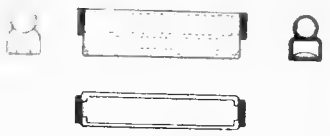
EXERCISING APPARATUS



No. 1,577,809, issued to Edward Thomas Randall. The exercising device shown above is designed inexpensively and durable. It is built to give the actions of rowing, with a sliding seat which may be locked in any position to permit other forms of exercises.

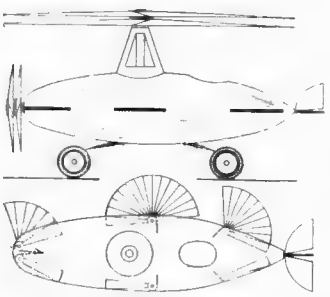
AIRPLANE DUSTING DEVICE





No. 1,584,945, issued to Elmer Johnson. The illustration above shows a device to provide a means of using the wings of an airplane for holding poison to be used in spraying fields. This supplies a means of spraying and killing insects when the plants have grown.

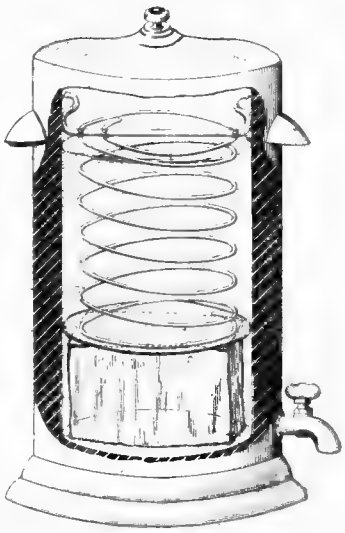
HELICOPTER 4



No. 1,622,191, issued to Antoine P. Filippi. The invention illustrated above is designed to provide a means of stabilizing a helicopter, besides providing a means of rising slowly and moving in a horizontal direction. It consists of supporting planes which may be adjusted.

WATER COOLER

No. 1,546,897, issued to William Herbert. The device shown below provides a means of holding the ice in a water cooler at the bottom of the tank, away from the warm water and air that collects at the top of the tank. The ice is thus conserved and cold drinking water is always obtainable.



OCEAN-POWER MACHINE

No. 1,623,341, issued to Charles N. Hare. The object of this invention is to provide an appliance, operable by wave and tide motion that is effective in compressing air and storing it in a tank of large capacity; and that also is actuated by the same means to exhaust air from a tank of large dimensions, so as to form a vast vacuum, and means in combination therewith to operate machinery.

PICTURE PROJECTION

No. 1,584,708, issued to N. Pemberton-Billing. The device illustrated below is for improvements in relation to picture projecting means. It is used to project pictures on a screen to illustrate the subject matter of a phonograph record. The projection of the pictures will be synchronous with the passages in the subject matter of the record which it is desired to illustrate.

MERIDIAN CLOCK

No. 1,581,910, issued to Roland F. Berrill. This invention relates to a watch, clock or the like which indicates the meridian of longitude, at which it is a given time. It is a variation from the usual meridian clock which has 360 divisions. The advantage of the new clock is that it is easier to read.

TOY EXERCISER

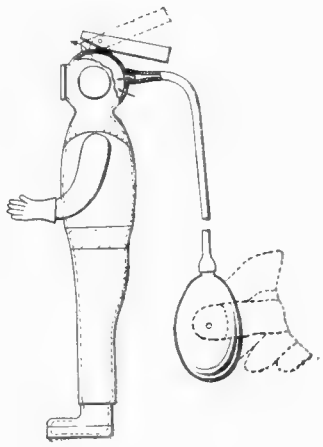
No. 1,626,161, issued to Wm. H. Sherrod. The device shown above relates to mechanical toys of the spring hobby-horse type. It is designed to afford exercise and amusement combined with safety.

HEATER

No. 1,578,741, issued to Sydney W. Lack, and A. J. Shepherd. The illustration above shows a device used to allow rapid heating of liquids in vessels or utensils by direct application of the flame, or heated gases resulting, to the bottom of the vessel.

AQUATIC TOY

No. 1,622,570, issued to Charles H. Budde. The illustration below shows a toy designed to alternately sink and rise in water under the action of compressed air. By expelling water from the body of the toy, its buoyancy is increased and by allowing water to enter the toy it is caused to sink.



MANICURING NOVELTY

No. 1,609,443, issued to Edna S. Tipton. The device shown below is an improved manicuring set. It is arranged so that the buffer is protected when carried in the pocket or hand-bag.

DISPLAY DEVICE

No. 1,581,118, issued to G. P. Herrick. This invention is a new and useful improvement in display devices. It is designed so that objects may be lifted and dropped in order to exhibit qualities or characteristics of the object.

NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information as it is practically impossible to obtain up-to-date addresses. —EDITOR.

THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

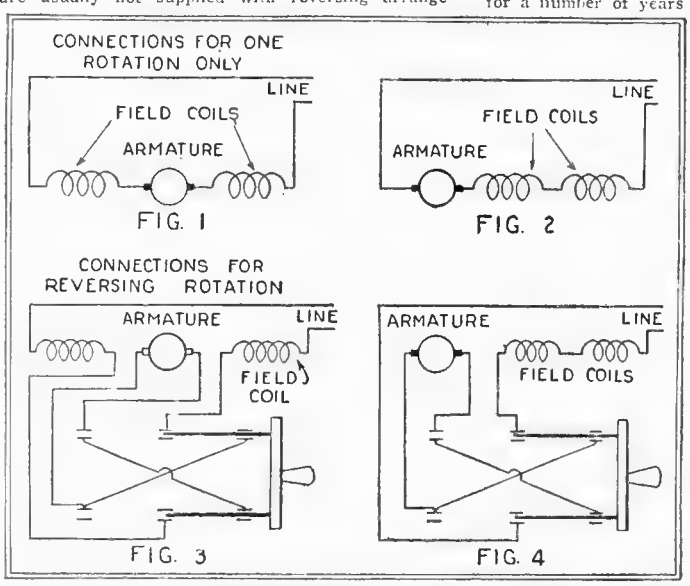
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculation, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

MOTOR REVERSAL

(2192) E. S. King, Rochester, New York, writes:

Q. 1. I have a small series-wound, direct-current motor which is not supplied with reversing arrangements. How can I reverse the direction of rotation of such a motor?

A. 1. Small series-wound, direct-current motors are usually not supplied with reversing arrangements; however, it is often found desirable to reverse the direction of rotation of such a motor and the diagrams reproduced on this page (1 and 2) show the two general connections for the field coils and the armature. Either of these types lend themselves to the use of a double-pole, double-throw switch for reversal. The connections for this purpose are shown in the diagrams 3 and 4. The connections shown in 3 are for a motor that was originally wired as in 1, while those in 4 are for a motor wired as in 2. This use of a double-pole, double-throw switch is one that is well worth remembering. It can often be applied to other usages aside from the reversing of motors. Where it is desirable to have the direction of current flow under control at all times, a switch with the poles wired as shown will be of service.



Figures 1 and 2 shown on the left represent the usual methods of connecting small series-wound motors. Figure 3 shows the method used to reverse the motor shown in figure 1. Figure 4 is the method used in reversing the motor shown in figure 2. As it may be seen in both cases, the armature winding is reversed.

TORSION BALANCE

(2193) Q. 1. Miss Helen Barrett, Tucson, Wyo., requests the definition of the term torsion balance.

A. 1. Quoting from The New International Encyclopedia, we have the following definition of a torsion balance.

The torsion balance is, "An instrument originally designed by the Rev. John Mitchell and after his death improved by Henry Cavendish, who used it in performing the well known Cavendish experiment of determining the mass of the earth. The apparatus was reinvented by Coulomb and is often known by his name; having been used by him to study electrical and magnetic attractions. It consists of a horizontal rod suspended by a fine wire or, in the most recent experiments, a fiber of quartz and carrying at both ends small spheres having a mass equivalent to 1 gram. Adjacent to but on opposite sides of these small masses are two large spheres of lead which attract the two smaller masses and cause the horizontal rod to deflect, the movement being observed by a mirror with telescope and scale as in the case of the reflecting galvanometer. The force of attraction between two different masses can thus be ascertained, and, as the attraction of the earth for a unit mass as well as its radius is known, we can thus determine the mass of the earth. In electricity charged conductors were substituted for the masses, and to study the strength and action of magnetic poles a long thin magnet was suspended and a similar magnet placed in a vertical position near one of its poles. The amount of force exerted was ascertained by finding the angle through which it was necessary to turn the head carrying the wire in order to keep the suspended bar at its original position. The Cavendish experiment enables the physicist to compute the mass of the earth and to determine also its mean density, which according to Boys is 5.5268.

ROSE CANKER

(2194) J. B. Hart, Bangor, Maine, asks:

Q. 1. I have been bothered by a brown canker-ous disease which has attacked my rose bushes. Could you suggest a remedy for this?

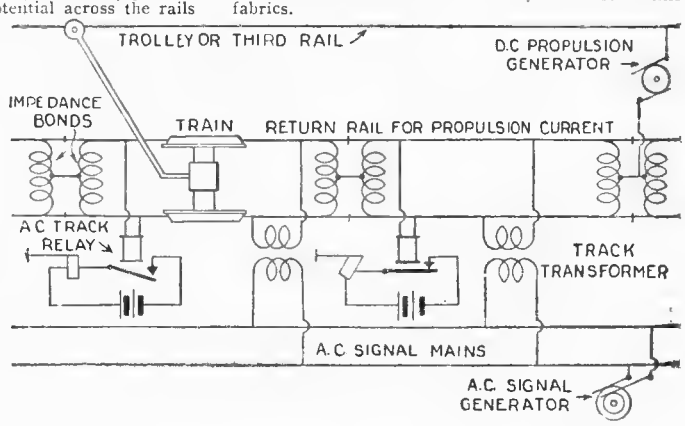
A. 1. The brown canker disease in roses which has been troublesome in many eastern rose gardens for a number of years is probably one of the most important diseases of outdoor roses and it seems to be spreading as well as increasing in severity. The fungus responsible for this disease does its chief damage by cankers on the shoots which are girdled or killed. The dead area of the cankers develops, in most cases, a brown or buff color, from which the name of brown canker naturally arose. The disease may be a cause of great loss in plants stored over the winter or in rose cuttings. It apparently spreads readily. To control the disease it is urged that care be taken to select for the rose garden only healthy plants. Careful pruning of diseased canes in early spring has not been as successful in keeping down the disease as might be expected. However, the use of Bordeaux mixture repeatedly during the summer, and particularly during the early period of shoot formation, appears to control the disease. It is recommended that a pound of fish-oil soap be added to each fifty gallons to make the mixture adhere to the canes.

RAILWAY SIGNALING SYSTEM

(2195) J. Calleo, Garfield, New Jersey, writes:

Q. 1. Will you give me a diagram showing the signaling system used on A. C. track circuits, double-rail system, D. C. propulsion?

A. 1. You will find illustrated on this page the A. C. track circuit double-rail signaling system. Where the conductivity of the return propulsion circuit is not sufficient to permit giving up one rail to the signal current, this arrangement is used. Both rails are sectioned by insulating joints and the return propulsion current is carried around these joints by means of impedance bonds; that is, coils having a high inductance and a low resistance, which are joined electrically at the mid points of their windings. The flow of the propulsion current is opposed only by the resistance of these bonds and their connections. The full impedance is, however, offered to the flow of the alternating signaling current from rail to rail, and it is, therefore, possible to maintain a difference in potential across the rails sufficient to operate the track relay. Where the propulsion current is alternating, a higher frequency is used for the track circuit and the relay made correspondingly selective. Twenty-five-cycle current is ordinarily used for the signals on direct-current propulsion roads and 60-cycle current on alternating-current propulsion roads.



The illustration on the right shows the A.C. track circuit, double-rail signaling system. This arrangement is usually employed when it is impossible to permit using one rail for the signaling system. When using this method, both rails are "sectioned" by insulating joints and the propulsion current is carried around these joints through impedance bonds.

PREPARATION OF HELIUM

(2196) A. Goodwin, Port Stanley, Ontario, Canada, writes:

Q. 1. Can you give me information regarding the isolation of helium in the home laboratory?

A. 1. Helium is, as far as known, absolutely inert, no substance being known to contain helium in chemical combination. The isolation of helium in the pure state is a matter of some difficulty. To begin with, some mineral containing the gas, like cleveite or uraninite is finely powdered and heated with dilute sulphuric acid, the air being excluded and the expelled gas being collected over mercury. The gas, mostly helium but containing also nitrogen and other atmospheric constituents is next transferred into an evacuated vessel partly filled with a mass of charcoal and cooled from the outside with liquid air; the charcoal gradually absorbs everything except the helium and part of the neon and if the process is repeated several times, nothing but pure helium will remain behind unabsorbed.

SINKING SHIP

(2197) C. H. Warner, St. Michaels, Maryland, asks:

Q. 1. If a ship sinks below the surface of the water will it continue on its way down until it reaches the bottom or will it remain in some intermediate position, buoyed up by the denser portion of the water?

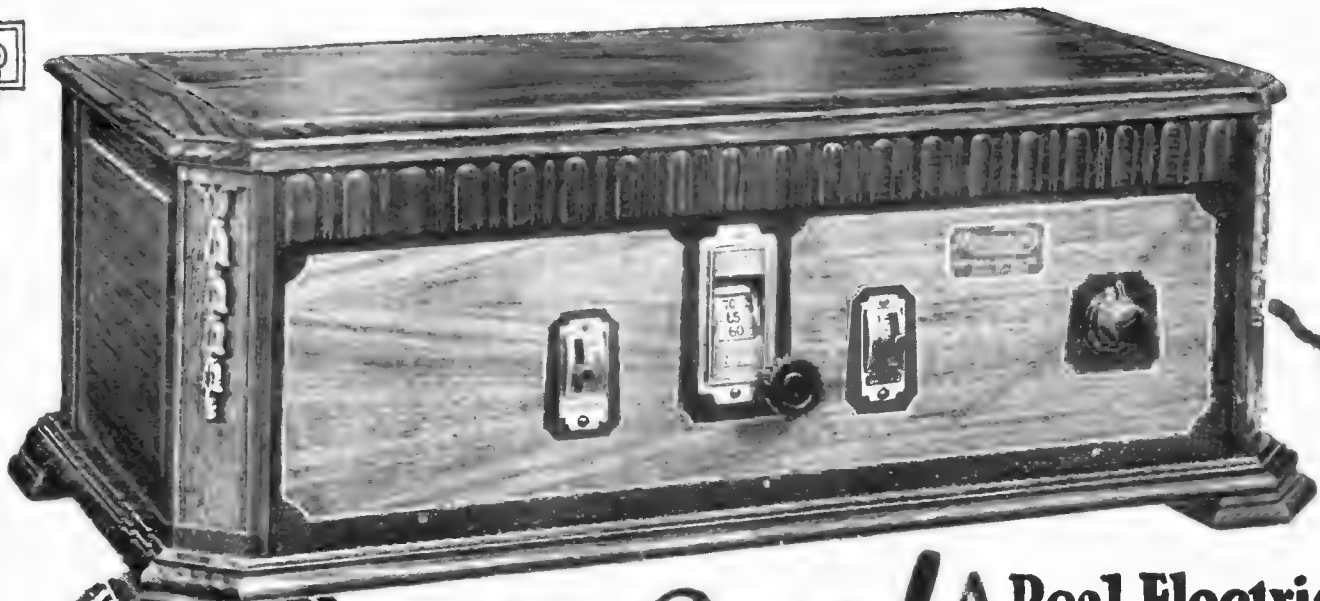
A. 1. When a ship sinks below the surface of the water, it will continue to sink until it reaches the bottom of the ocean where it may or may not come to rest, dependent entirely upon the currents and the nature of the ocean bed. Sometime after a storm, a vessel at a depth of 150 feet will be carried clear out to sea and lost for months, as divers have frequently discovered. There is no such condition as a ship sinking and coming to rest in the denser portions of the water, which are naturally down at the bottom of the ocean, because water is not divided into definite strata and while it is true that the pressure exerted on a vessel is greater in an upward direction, it is also true that a similar and identical pressure is being exerted in a downward direction. It has been discovered that a submarine can not maintain a state of equilibrium, that is, it can not sink to a depth of 20 or 30 feet or more and stay there without the necessity of hovering in that particular position. This is accomplished either by means of elevating and depressing rudders when the submarine is in operation or by means of compressed air which lets in a small quantity of water into the ballast tanks or expels this quantity of water, replacing it with air when necessary.

KEROSENE EMULSIFIER

(2198) S. Hagerman, Carson City, Michigan, asks:

Q. 1. What chemical or chemicals will emulsify gasoline or kerosene with water and yet will not stain or injure fine fabrics? The solution is to be about 90% water and 10% of the other liquids.

A. 1. An emulsifier for kerosene or gasoline and water consists of whale oil soap or ordinary household soap. To each gallon of water ½ pound of soap should be added. If a good quality of soap is used the emulsion will not injure or stain fine fabrics.



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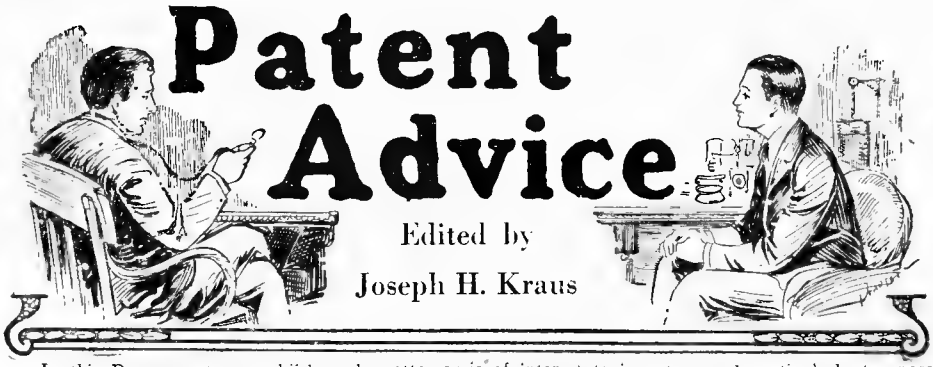


In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

MULTIPLE ELECTRODE VACUUM TUBE

(1037) H. M. McClearen, Exeter, Calif., requests our opinion of a multiple electrode vacuum tube with odd plate and grid arrangement.

A. 1. We are inclined to believe that any attempt to place several additional electrodes in a vacuum tube would tend to make the vacuum tube less satisfactory than those employed at the present time.

Every vacuum tube which we have seen and which has a multiplicity of plates does not serve as well as those audions which have but a small plate, a small grid and a miniature filament. It seems that if the internal capacity of the tube is reduced, the tube works far more efficiently for R.F. circuits.

You can demonstrate whether or not your tube is capable of performing better than those tubes now on the market by having a model built and trying it out in a test circuit. Theorizing is of no avail; it requires practical experimental work to determine the possibilities at hand.

We, therefore, advocate that you have some tube manufacturer build up several samples of tubes in accordance with your specifications and that you try them out in regular receiving circuits.

AUTOMOBILE AIR PUMP

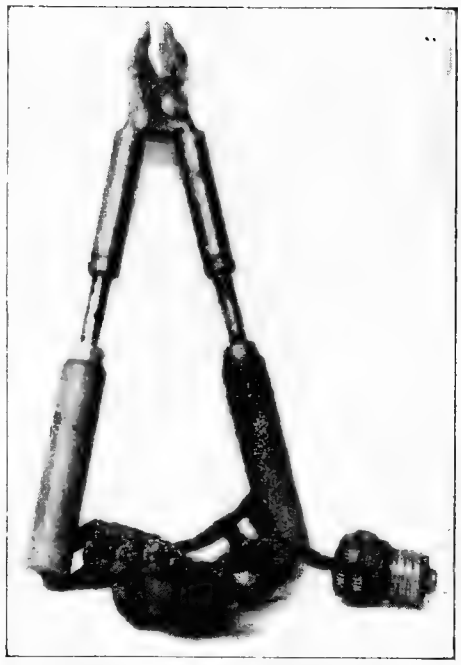
(1038) August D. Blanke, Illiopolis, Ill., submits a sketch of an automobile tire pump for use on ordinary automobiles and directly attachable to the fan belt.

A. 1. We do not believe that a fan belt will give a positive enough drive for an automobile pump of the nature you have described. Neither do we hold that the attachment of a pump in this particular position is practical. The pump would have to be fastened to some portion of the engine itself or to the bed. This necessitates the drilling of holes into the bed for the screws which are to hold the pump and likewise necessitates the use of an adjustable bracket so that the pump can be placed in the proper position for the drive.

There are on the market at the present time several kinds of pumps which may be inserted into the spark plug opening and others which couple directly with the engine. Both of these are far superior to the suggestion advanced by you, but in spite of this, they are not very saleable. With modern free air stations, it becomes a simple matter to inflate the tires without the use of an engine operated pump and without requiring the extra expenditure incident to such a pump. A few strokes with a hand pump (a much cheaper article) will give the rider enough air to reach the nearest air supply station. It might also be mentioned in passing, that modern automobiles generally have an inflated spare tire. It is then not necessary to pump up this tire, nor does one need to repair the punctured tire on the road. We do not advocate that you apply for a patent on the suggestion.

(1039) Frank Miller, New York City, submits a suggestion for a pair of pliers provided with wooden handles and resistance wires so that they can be used for soldering. The pliers themselves get hot enough to melt ordinary solder.

A. 1. It seems strange that in the same mail a pair of soldering pliers utilizing the same principle and invented by Joseph Malone, also of New York City, was called to our attention. Mr. Malone claims to have a patent pending on these electrical soldering pliers. A photograph of the article, as invented by Mr. Malone, appears herewith. Had you applied for a patent on this suggestion before writing us, you would probably have found it necessary to establish your claims of priority. Inasmuch as Mr. Malone has already reduced his invention to practice, and has applied for a patent, we believe it would be difficult for you to protect your idea. This case graphically indicates the necessity for establishing claims of priority. We frequently hear of such circumstances, but this is the first time that we have been able to present them in such concise form before our readers. The association of ideas and the coincident arrival of both letters is something perhaps for our spiritualists to figure out.



ELECTRIC SOLDERING PLIERS

CAN PATENT BE OBTAINED?

(1040) H. F. Hoyt, Ocilla, Ga., would like to know if he can patent an idea, the initial parts of which are now in daily use.

A. 1. It is difficult to state whether you could patent your suggestion or whether it cannot be protected. It would depend entirely on the nature of the article, which you did not specify in your communication. Take for instance, a radio receiving set. The vacuum tube, detector, condensers and tuning coil, even if patented, would not prevent someone else from patenting an entirely new circuit for use of the same instruments. Flexible chain drives have been in use, yet the employment of a chain drive as a gearless transmission system has recently been protected.

(Continued on page 446)

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LABEL PASTE FOR TIN BOXES

(1041) O. P. Clifford, Quincy, Mass., asks whether it would be advisable to protect a paste which firmly holds labels to tin boxes.

A. 1. The addition of various salts to paste so as to form a slight corrosion or a corroded surface on the tin box and in that way assist in the adhesiveness of the paste, when used with labels and tin boxes, is well known. Adding any other product to ordinary paste would not constitute a patentable suggestion; the only way you could dispose of the material would be to manufacture the paste and sell it through your own agents or sell the idea to some large paste manufacturing concern. We do not believe that you will meet with success in the latter project because the various manufacturers have found substances which will answer the purpose. The group of users for material of this nature is quite large and it might pay you to market your idea.

COMBINATION PIPE AND CIGARETTE HOLDER

(1042) William S. Vollendorf, Alberta, Canada, submits a suggestion for a combination pipe and cigarette holder in which the same stem is used, but the tips or ends of the stem are interchangeable.

A. 1. Combinations of the nature designed by you have never met with favor and we would certainly advocate against applying for a patent on the suggestion. There is no great advantage toward having one stem for a series of pipe ends unless that stem could be made of gold or some other superior material. In view of the fact that the bowl of a pipe is the most expensive part, and also in view of the fact that stems of either cigarette holders, cigar holders, or pipes are the cheapest portions of such a product, it is inadvisable to apply for a patent on the suggestion.

The Astrology Humbug

By JOSEPH H. KRAUS

(*Continued from page* 421)

S T 0-36-21 using a 1926 ephemeris for illustration.

Sidereal time means that 365 days is divided into 24 hours—based from March 21st—0 degree Aries—to the same 0 degree—only the Astrologers have abandoned Ptolemy who had a disc earth and sun motion and have gone over to Copernicus with a whirling globe.

I am glad S & I has made this offer to Astrologers to prove their science.

Not all Astrologers use the above Sidereal Time adding and subtracting—but some of the self anointed ones do—and boast of their greatness—and I'd like to know how they take hours away from a four minute day.

It would be as sane to ask—If a man drinks 16 quarts of milk in 24 hours how far will he run in 2 months.

EZRA R. AVERILL—*Editor Kingdom of Heaven Advocate,*
Grand Rapids, Mich.

(It is usual for anyone having no other arguments in favor of any science to question the ability of a second party to pay an offered award. SCIENCE AND INVENTION Magazine; RADIO NEWS; AMAZING STORIES; SPARE TIME MONEY MAKING and RADIO REVIEW are all publications of the Experimenter Publishing Co. These publications enjoy second class mailing privileges. The Post Office Department of the United States (and there is no other like it in the world) pay particular attention to any contests published in any magazine enjoying such second class privileges. The contest must be worded correctly and the awards must be made in accordance with contest conditions. If this is not done, the second class mailing privileges are immediately taken away.

Now then, let us assume that all of our magazines have merely a circulation of 100,000 and let us assume that a copy of the magazines is sold for only 10c which of course it is not. The total income would then be $10,000. Why could we not pay an award of $6,000 and enjoy the monthly income of $10,000? That is sheer nonsense.

But the circulation of SCIENCE AND INVENTION Magazine is approximately 150,000 and that of RADIO NEWS, 250,000 and we have not yet taken into consideration the other publications enumerated above. This shows clearly that an income more than four times as much might be instantly stopped if we did not live up to the contest conditions. Any post office action would be taken against the Experimenter Publishing Co. and not against an individual magazine.

And the funny part of this entire argument is that the "Student Adepts" should know these things and undoubtedly they do; therefore, their questioning our ability to pay a $6,000 award is just done for publicity purposes and other than that it has no meaning, it is mud pure and simple—just a statement made to obscure an issue.

During the past year SCIENCE AND INVENTION Magazine paid more than $6,000 for Matchcraft constructions alone. These facts can be verified from our files or should anyone desire the information, he can write to the prize-winners whose addresses are given in each and every issue of this magazine.

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Answers to Scientific Problems

(*Continued from page* 416)

THE BOY AND THE PLANK

At first this puzzle appears to be similar to that of lifting oneself by his own bootstraps. For, any pull applied to the rope will increase the force on the board. But the force thus added is applied nearer the pivot and hence the gain in leverage more than offsets the increase in load. The exact force required can be computed by the principle of moments. Thus if X is the force on the rope, the vertical or effective component of this force will be CD which equals. $\frac{X\sqrt{3}}{2}$. Then since the downward force at B is increased by this same amount the total load at this point will be $120+\frac{X\sqrt{3}}{2}$. Now by equating moments with respect to the pivot A

$$\frac{X\sqrt{3}}{2}\times 4=(120+\frac{X\sqrt{3}}{2})\times 2$$

On solving for X we find that the force required is about 140 lbs.

THE ELECTROPLATING PROBLEM

If the storage batteries are connected in series they will supply 12 volts to the plating cell. Then since the resistance of the circuit is 3 ohms the current that will flow will be 4 amperes. But as both batteries supply this same current they will both have furnished 100 ampere-hours in 25 hours and hence will be discharged. If, on the other hand, each battery is attached in turn to the cell the current supplied will be half as much or two amperes, but each battery will last for 50 hours and therefore do twice as much plating. The resistance of the storage batteries is taken as negligible.

THE STREAM FROM THE FAUCET

When a stream of water issues quietly from a faucet the cross section of the stream is smaller at the bottom than at the top because the stream is moving faster.

CAN A FISH SWIM?

The difficulty suggested by this problem arises from the form in which it is stated. "The fish cannot move forward until the water has moved aside" implies that one act must be completed before the other can begin. As a matter of fact both occur simultaneously. A more accurate description of the event would be: The water moves aside *as* the fish moves forward. Stated in this manner no dilemna appears.

THROWING A PIECE OF ICE

A piece of ice can usually be pitched farther along the surface of a frozen pond than it can be thrown through the air. This is partly due to the very low coefficient of friction between ice and ice and partly due to the fact that when a body that is thrown through the air it inevitably looses a considerable portion of its energy in impact on striking the earth, whereas in the other case the entire energy is eventually spent in overcoming sliding friction.

THE TUMBLER PROBLEM

After the tumbler has been inverted, the pressure of the air within the tumbler must be less than atmospheric. The additional weight of water actually presses the plate slightly off the mouth of the tumbler, thereby enlarging the cavity and thus reducing the pressure of the air within the tumbler. The water film around the edge of the tumbler is kept intact by surface tension and by atmospheric pressure.

AIR IN AUTO TIRE

The pressure of the tire against the pavement produces a more or less evident con-

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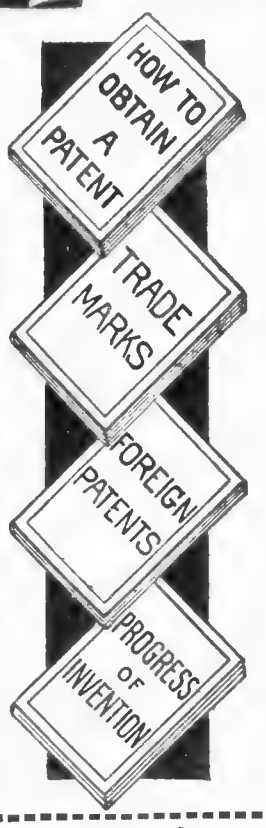

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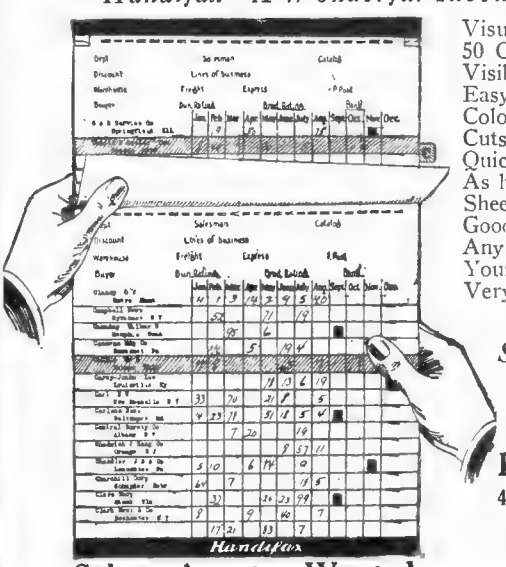

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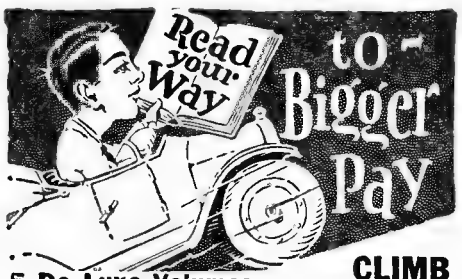

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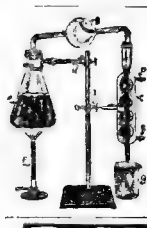

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Answers to Scientific Problems

(*Continued from previous page*)

striction of the air column within the tube, depending of course on the degree of inflation. As the wheel turns around, this constriction is made to pass around the tire in a direction opposite to that of rotation. This action would evidently tend to force the air around the tube in a direction opposite to that of the motion of the wheel, but of course this does not mean that the air would not move somewhat with the wheel, except in the case of a flat tire.

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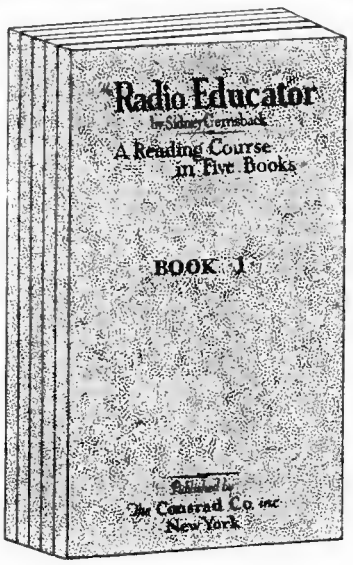

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Ships that Never Sail

BY G. H. DACY

(*Continued from page 422*)

If you visit the U. S. Naval Academy when the world's finest maritime school is in session, you will find certain classes in navigation, ship design and nautical lore using small models of ships or parts of vessels instead of textbooks in their scholastic work. These models are provided by the Washington Navy Yard. They are accurate in specification and faithful in detail. They facilitate the training of youthful sailors on land so that they may potentially go to sea. They are small scale laboratories which aid instruction in seafaring sciences. Thus these ship models gain economic significance and practical use as the mute assistants of naval instructors.

Our national ship models also are federal archives which write the records of revolutions and evolutions in ship building. Inspect these models in chronological order and you soon see that they are stepping stones of our forward march in marine architecture. Place them side by side as representatives of ship construction from the days of the Bon Homme Richard, John Paul Jones' famous flagship, up to the era of the enormous U. S. S. Massachusetts and you will note that they constitute a wooden visualization of the advancement which America has made in ship building.

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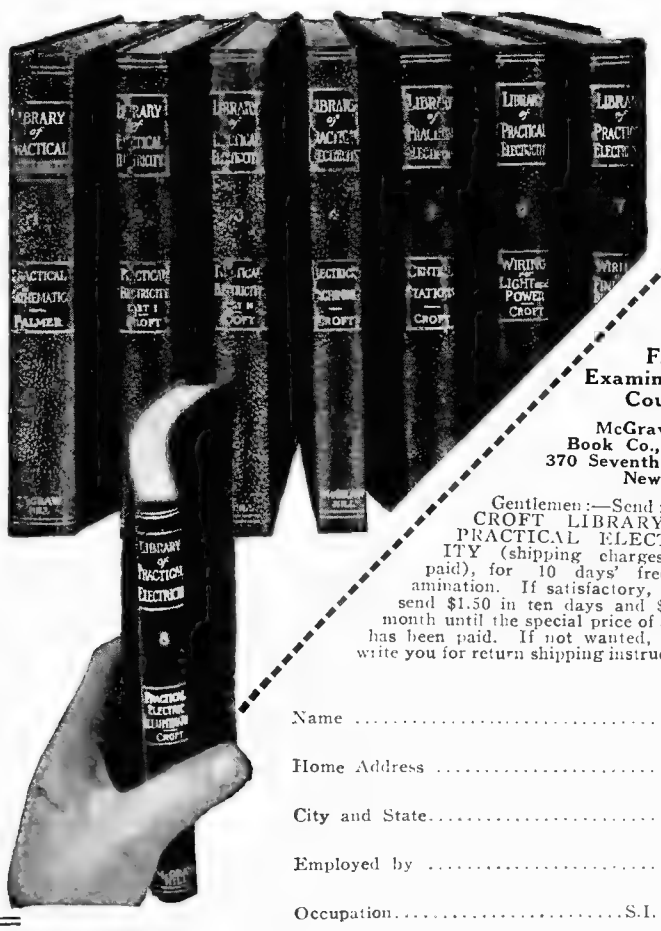

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Name ----------

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---------- *Age*-----

The hull is cut, carved and chiseled from a piece of white pine timber. Some of the models are 12 feet long or more and 12 to 14 inches wide, so that you can appreciate that they are the ultimate products of large, straight-grained planks fastened together with durable glue. The hull of the model has to be equipped with rudder, propellers, shafting, struts and a waterline draught scale. All the hull is exposed when the model is used for exhibition purposes so that the underwater parts must be shown in detail.

The hull is solid for there is no need of hollowing out the interior. The naval experts aim to produce models which will be so accurate in detail and so truthful in design that neither laymen nor seafaring folks can find flaws nor faults in the diminutive ships. The graceful lines, the relative proportions and the carefully unified portrayal of the mother ship must be reproduced in the model.

In the early days of ship model making, the Government builders used German silver or "white metal" to simulate the metallic parts of the ship. Smoke stacks, anchors, deck rails and other equipment were reproduced in German silver effigies. Many of these parts were masterly products of painstaking skill. The models were handsome ornaments which had to be scoured and polished regularly to keep them in the pink of exhibition trim.

The modern models substitute the use of wood as far as possible for metal parts. These are painted to simulate the actual equipment on the ship. The use of wood speeds up the construction without detracting from the educational value of the exhibit. Certain parts, of course, have to be made of metal. Wooden forms are made and pewter or soft lead castings are produced. Other equipment is made of brass. Solder is employed to assemble the different parts.

Celluloid is used as imitation window glass for the pilot houses and airports. Each air port consists of a small brass ring fitted with a shoulder which holds the tiny circular bit of celluloid. Grassline thread or fine fishline are used for rigging and cables. Some of the cruisers and battleships require from 250 to 350 yards of this material apiece to fully equip them with the proper rigging. Ship rails and stanchions are made from flat strips of fine brass by turning them over special dies. Lifelines in the form of strong fishline is threaded through these rails. The glass used in the searchlights is scratched with special tools so as to look as though it was composed of several small strips of plate glass.

The lifeboats, work boats and launches are made of white pine, carved, cut and hollowed out to look exactly like tiny boats. The interiors of these craft are cut out and such appliances as engines, rowing seats, steering gear, propellers and rudders are provided. The cocoanut matting which covers the walkways along the decks is represented by painting the deck of the model where this covering would be used.

Some of the recent models are equipped with radio appliances of the most approved patterns. In order to insulate the stays, shrouds and similar rigging equipment, glass beads are strung on the fishlines. This insulation system facilitates the use of the radio apparatus.

The last model made at the Washington Navy Yard is a small scale reproduction of the Richmond, a 10,000 ton naval cruiser. This ship is 555 feet long while its model is 11 feet 9 inches in length and 14 inches in beam. It is generally recognized as the finest piece of model work produced since the U. S. Navy engaged in such operations. A professional modelmaker told the writer that it would cost at least $15,000 to make such a model under present conditions.

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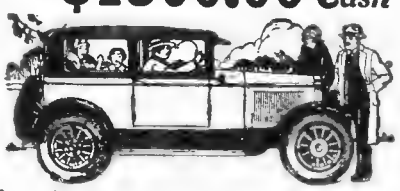

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2	21	9	3	11	7	9	22	5	14

Can you make out the two words spelled by the numbers in the squares above? The alphabet is numbered, A is 1, B is 2, etc. What are the two words? Send your answer today—not a cent of cost to you now or later.

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The Romance and Casting of World-famous Bells

By EDNA MacDONALD SERREM

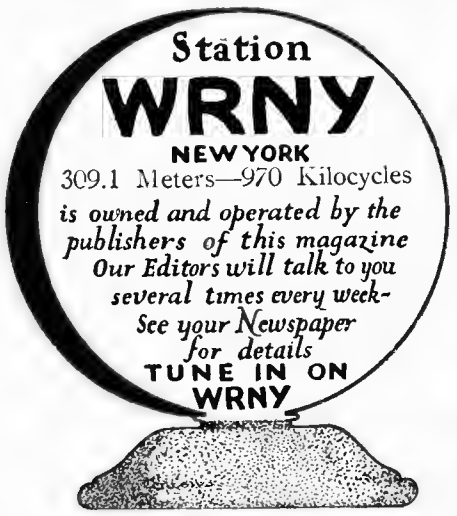
(*Continued from page* 409)

out Russia. They are all fixed immovably to their beams, and their tongues slung by means of leather bands which are moved by ropes in such a manner that the blows fall upon the surface at irregular points.

A bell of particular interest in America is the famous "Liberty Bell." It is now suspended by a chain of thirteen links, from the ceiling of the State House in Philadelphia. The bell was cast in 1735. Under it the representatives of the thirteen colonies first proclaimed liberty. The break in its side occurred later during the ringing of a fire alarm. The bell is inscribed: "Proclaim Liberty throughout all the land unto all the inhabitants thereof."

In 1876 a bell which weighs thirteen thousand pounds to represent the thirteen original states, was made by the Troy bell manufacturer. It hangs in the tower of the old State House, above Independence Hall, where the old bell was formerly suspended. Like the old bell, it too, bears the inscription proclaiming liberty. This bell is in constant use, sounding the hours in beautiful deep tones.

All nations, with the exception of the Turks who hate and fear them, have highly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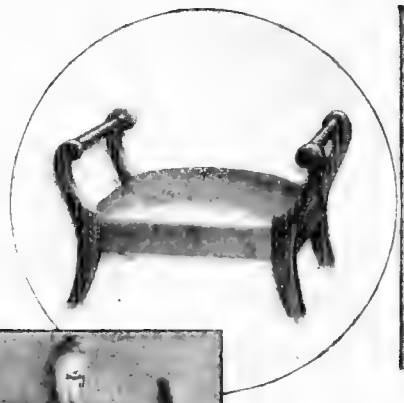
regarded bells. A marvelous number of changes can be played upon chimes of bells. On twelve bells alone, no less than 479,091,600 changes can be rung.

DETAILS OF BELL MANUFACTURE

Bell foundries, by experimentation, find and invent formulae for the making of bell metal which they decide upon as best suited to their ideas and desires. The product of each foundry is recognized as being somewhat different from that of others, because of the difference in formulae. Each foundry owns its own formula. Thus, bells from certain foundries may be preferred to bells manufactured by other foundries, due to the variation in per cent of metals involved in the making. This, in spite of the fact that all bell-makers realize and admit that the ordinary alloy used by bell manufacturers is about seventy-eight per cent new Lake Superior copper with twenty-two per cent new block tin. It is the slight changes made by individual bell-makers on this original formula, in addition to other individual methods of manufacture in shape, etc., that provide the distinction in the product coming from the manufacturer.

This fact also accounts for the difference, among other items, between bells of American manufacture and those of foreign manufacture. A possible exception may be made here in the case of England. English and



FOOT STOOL
See LePage's Book, page 23

HANGING BOOK SHELVES
See LePage's Book, page 25

BACK REST
See LePage's Book, page 24

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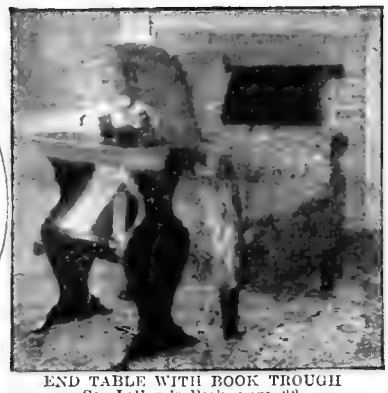

END TABLE WITH BOOK TROUGH
See LePage's Book, page 22.

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NOW with the coming of fall and the home work shop season, comes this NEW LePage's Home Work Shop Book to show you how to make 20 different pieces of gift furniture, designed by an expert—attractive, artistic, useful, practical and easy to make.

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In addition to the four pieces illustrated above, the projects include the following: Table with side flaps and two drawers, Spanish Ship model, folding sewing screen, fernery stand, tilt top table, piano bench, costumer, Priscilla sewing box, Cedar Chest, Smoking Cabinet, table desk, desk chair, card or console table, book stand, turned bench, dressing glass. Where else could you get complete directions for making all these things for only 10 cents?

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Below is a reproduction of Mr. Gale's letter of May 8th, 1927.

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American bell-makers have always held to practically the same ideas and methods. But there is a pronounced difference between the bells of these countries, America and England, and the bells of countries including Italy, France, and others. This is an interesting condition. The following data will give the explanation.

The pitch of a bell, the type of its tone, in other words, is determined by two main factors in its manufacture—the weight of the bell and the shape of the bell. The general rule is followed by pattern. For instance, a thousand pound English and American bell, will ordinarily strike the key *A Natural*. This is expected and counted upon by the maker, who applies his formula to obtain this result. But the American and English key of *A Natural* strikes a lower, fuller tone than the same key-tuning employed by other bell-makers. Therefore, the bells of England and America possess a richer range of sound throughout the whole scale of bell-sound. This is due primarily to the thickness of the bell in its finished state. More metal is contained in the bell, and therefore there is more resonance and more power. The bells of Italy and France strike a higher, sharper note. There is less metal in the bells, with the lessening in fullness of tone. The quality of American and English bells may thus be considered higher.

The tone of a bell is the result of vibrations. When struck, a bell changes shape, and these repeated changes constitute its vibrations. At one moment a bell is an oval, with its longest diameter at exact right angles to the position of its longest diameter at the preceding instant. The number of vibrations produced in a bell in a given time varies, directly, as the square of the thickness, and inversely, as the bell's diameter, or as the cube root of its weight. By this knowledge, the production of any given tone in a bell is readily secured. In a set of bells forming a complete octave the diameters would appear in the following proportions: C-1, D-8/9, E-4/5, F-3/4, G-2/3, A-3/5, B-8/15, C-1/2. The diameters of bells correspond to the lengths of musical strings.

While all bells cast from the same mold will be approximately of the same pitch, there will be individual differences which can be detected by the trained ear. When assembling a set of chimes, each bell must be tuned in harmony with the others, each bell, of course, being of a different pitch, or key. This is done by striking the bell with a wooden mallet, and comparing the tone of the bell struck with the tone of a designated common tuning-fork.

The pitch of a bell is lowered by grinding metal from the interior of the bell (the sound bow), as indicated in the diagram. This must be done carefully and really slightly, so as not to remove any great amount of the original cast, since to do so will detract from the quality of tone, as stated before.

The pitch of a bell is raised by removing metal from the rim, thereby decreasing its diameter. The tone is then higher and less round in volume.

A portable grinder is used in these operations, and the amount of metal removed is determined by a cut and try method.

Carillon playing by an expert is done by hand at present, although there has recently been developed a device for electrical operation of the chimes by an ingenious application of electro-magnets to the mechanism operating the clappers. The control is a simple key-board, similar to a piano key-board, reduced to fit the chimes, which may be placed wherever desired. The success of this invention opens up great possibilities for distant control of carillon music, and especially for the unison of the chimes and organ in churches. But as in all playing of music, the interpretation of the melody may be robbed of a certain fine artistry, and become too mechanical, in the grip of machinery. The human touch may be lost.

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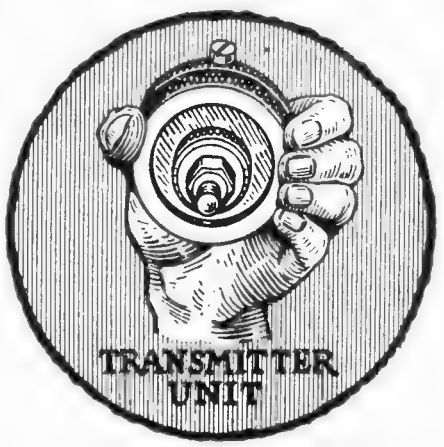

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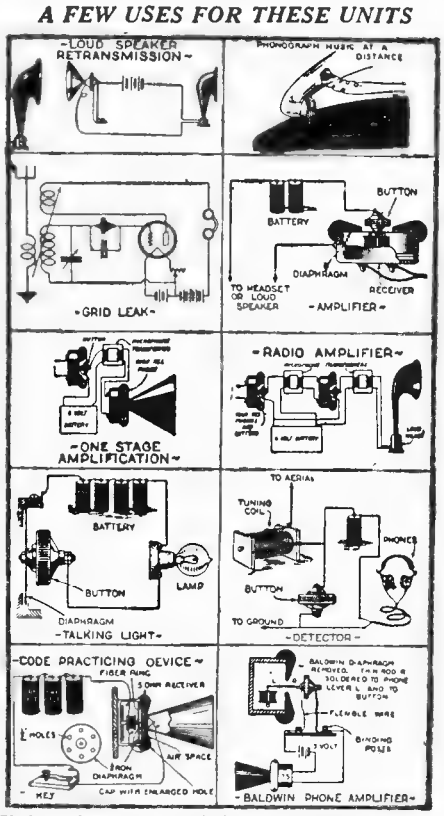

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The Radio Séance

By KARYL KANET

(Continued from Page 415)

to drown out that of the professor. "We understand that you serve as the aerial, so to speak. That your spirit catches the spirits in the void and transmits them through the ether to the loudspeaker of the instrument. We have heard that you have had great and astounding results. Madame Lulu, we are here to be convinced."

He turned to the others. "Is that not so, my colleagues?" he demanded.

All nodded solemnly.

"We will make it worth your while, Madame Lulu, if you convince us," he went on. "Remember, the Society will give one hundred thousand dollars—*One Hundred Thousand Dollars*—to you for personal research," he said impressively.

"Let us now look carefully about this room, with madame's permission, to see that there are no instruments of deception here."

Madame Lulu had to watch her speech carefully to be sure that her Irish brogue did not slip out now and then. So she spoke very slowly and distinctly.

IMPORTANT

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"Go right ahead, gentlemen. I assure you you will find nothing in this room to cast any doubts upon my honesty. I am sincere. I am psychic. I speak to the spirits. You will find no trickery because there is none."

The committee rose to investigate. Very carefully they went over the room, examining every nook and corner. It was quite small, and except for the ceiling, completely done in black. The walls were covered with folds of black cloth. The floor was completely covered by a soft black rug. Even the windows had black hangings, as had the door through which the party had entered.

The only furnishings in the room were the black-painted chairs, arranged in a semicircle before a very low platform, on which stood another, larger black arm-chair. On this Madame Lulu was to sit. The only other object in the room was a fine six-tube superheterodyne radio set, in a large carved cabinet, standing on a black-curtained stand near one wall, but separated from it by about three feet of space.

The one peculiar feature of the set was the fact that there were no wires leading from it. There it stood, not connected in any way.

There was no entrance to the room, the committee found, but the door through which they had come, which was behind madame's chair. The only other openings were the two windows, both on the street side of the room and four stories from the street. There

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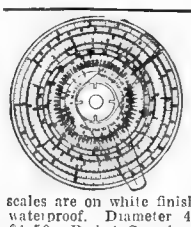

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were not even fire escapes from the windows. The room was completely cut off from the rest of the house, the only connecting link being the door. This led into a long passage, completely empty, which led directly to the foyer and the outside door.

The committee conferred, while Madame Lulu, seating her fat bulk on the chair on the platform, watched them closely. It was plain to be seen that they were surprised.

Finally they all came back to their chairs before the platform.

"Madame Lulu," said Coyle, "we are satisfied, at least with the room. We must confess ourselves surprised, for we had expected to find at least some wires."

Madame Lulu smiled.

"Let us now continue with the seance," Coyle, a hardened veteran of many seances, went on. "If it proves sincere, and we find no trickery, Madame Lulu, you are MADE!"

"This will revolutionize the world! It will be the great sensation of the age! To think of spirit voices being caught as radio waves! The wisdom of the ages will be at our call, and we—the Society—will give it to the world!"

Madame Lulu smiled again, like a cat licking cream from its whiskers. She could almost feel that $100,000 in her hands. It was hers, she was sure.

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The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

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Most of the shares of stocks for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stocks at $100.00 per share.

Therefore the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

"I am glad you are satisfied, gentlemen. Now we will begin. Will someone please draw the window-curtains? Now, kindly sit in those chairs. You will see that they are arranged so that we can hold hands in a circle. That will establish a circuit. Mr. Coyle, you sit here at my right and hold my right hand. Mr. Jimpson, sit at the left and take my other hand.

"Are you all ready?"

Dr. Jeemes was sitting next to Coyle. Professor Littleton was seated by Mr. Jimpson, and Howdidhe was facing Madame Lulu and the door. They all nodded.

"Very good. Now, will someone kindly put out the light? We must have complete darkness for the best spirit reception."

Jeemes reached for the long chain hanging from the ceiling electric light. He pulled it, and instantly the room was plunged into the deepest blackness.

"Now all take hands. Remember, the circle must not break, no matter what happens. If it does, we will break the spirit connection," Madame's voice rose out of the dark.

There was a long, very impressive and awe-inspiring black silence. The only sound, and that very slight, was the faint crackle of taffeta as the silk on Madame Lulu's bosom stirred with her breathing. Finally the breathing became audible. There was a deep breath, almost a sigh, from the platform.

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"She is growing rigid—she is going into the trance!" whispered Jimpson, who held madame's left hand.

"Sh—sh—sh—sh."

They waited in the pitch-black silence for another long minute or two. The only sound was the cautious breathing of the men and the deep, sighing breaths of the woman on the platform.

Then suddenly, from the side of the room where the radio stood, came the throaty sound of a radio being tuned in. There followed a slight noise, as of static.

The committee sat bolt upright in their chairs, gripping each other's hands nervously.

"Gr—r—r—ah—ah—ahhhhhhhh," said the radio, statically.

Then came a deep man's voice.

"You have called," it said gutturally, "and I have come." It stopped, leaving a tense silence.

No one moved. The committee sat frozen in their seats.

"What is your will? Answer!" the voice commanded.

"Who—who—who——" the professor stammered.

"Is it an owl I speak to?" the guttural voice asked.

"Who—who—are you?" Professor Littleton finished with an effort.

"I am Chief Laughing Gas, who roamed the forests long before your spirits left the void to live on earth. I am heap big Indian hunter. Ugh!"

They all jumped as the blood-curdling war-whoop rang out in the dark.

WANTED

Copies July 1926, Science and Invention. Write I. S. Manheimer, c-o S. & I., 230 Fifth Avenue, New York City.

"Wh—wh—where are you from and how did you get here?" Jimpson found courage to ask.

"I was caught by the strong will of the woman, and brought here to this instrument. I come from beyond—beyond—beyon . . ." the voice trailed off, with echoes of "beyond." Finally, with a last wailing "beyo——" it was gone.

"Here! Chief! Come back! Come back! We want to know more!" called Jimpson.

There was no answer but the "ahhhhhhhhh-zzzzzzzzzzz" of the radio. Again there was silence, tense and electric, accented by the deep breathing of the entranced medium, while the committee sat holding hands tightly, waiting.

"Oooooh, nice peoples," it was a thin, childish, falsetto voice. "Why you call 'ittle Sunshine?"

"Who are you?" asked Howdidhe, the magician.

"I 'ittle Sunshine. You want talky-talk wiv me?" the voice was very high and childish, almost infantile.

"Oooooh, I nice 'ittle spi'it. I 'ittle anjil. All anjils loves me, them does. Big mans loves me too? I ve'y happy. You wanta come play wiv me, nice mans? I give you dolly, I will, ef you comes. You be ve'y happy here, too . . ."

"Have you any messages for us?" Jeemes asked, tremblingly.

"Ooooh, yes, nice mans. I got p'itty message for you, I have. Big mama anjil say ev'ything all right. She say to not worry. You worry, big mans? Ooooo, naughty, naughty."

The infantile voice prattled on, coming from the side of the room where the radio stood. No one interrupted.

OVER THE HEAD OF THE MAN *who had hired him!*

INVITED as they are into all sorts of business offices, our representatives come across some very dramatic incidents. For example:

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The purchasing agent looked out of the window a minute before replying. Then he said: "I remember the day the President enrolled with you. He was one of my assistants. I am the man who hired him."

* * * * *

Promoted over the head of the man who had hired him! There is an element of triumph in that story, and an element of tragedy. To one man it meant the attainment of his goal; to the other, failure.

But why did it happen? Because one man was a subscriber to the Institute Course while the other wasn't?

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Two types of men enroll with the Institute:

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2. Men already at the top (more than 38,000 presidents have enrolled, for example). Such men have no thought of following the Course in detail, but they realize that one single paragraph in any chapter may have just the idea that will solve an immediate problem or increase immediate profits. Such men keep the Course at their elbows and, by so doing, have in their own offices a staff of $100,000 advisors, each a leading success in his own particular field.

If you are in one of these two groups—we want to send you a tremendously interesting little book. It tells just how the Course is arranged for practical use and gives, in brief summary, the experiences of 300,000 men who would no more think of being without this modern aid than they would be without the typewriter or the telephone. You can read this little book in half an hour; you owe it to yourself to know its story.

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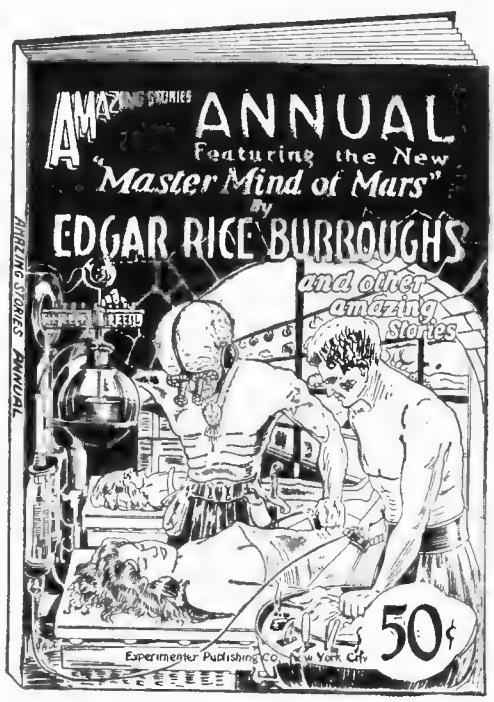

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"G'bye, nice mans," it said at last. "Big lady anjil comin'. She say she want talky-talk wiv you. Tiss 'ittle Sunshine, nice lady. G'bye, ev'ybody, g'bye,' the voice trailed off.

Again there was the throaty "ahhhhhhhhh" of a tuned-in radio.

"I come! Didst call?" it was a woman's voice, low and pleasant.

"Who are you?" asked Howdidhe, the only one of the group with enough courage left to speak.

"I am hight Rowena, lady of the Castle Gray. I wot not what thou wilt, fair sires."

"How did you get here?"

"I come afar. I have flown amain. But stay! 'Tis strange, passing strange, Sir Knight, thy speech. Knowst not the tongue of Arthur's realm? Art heathen, sir?"

As one man, the members jumped. What!! A ghost from away back in King Arthur's time? Did medieval ghosts walk too, in those modern days?

"Wheeew!" Howdidhe gave a low whistle of incredulity.

"Dost doubt me, sirrah? 'Thou, I mean, thou that sittest there. Dost not know that I could slay thee with a single blow? But enough of threats and doubtings. I bear messages, words for thee from this, the other world.

"For thee, sir that doubtest, I come to tell, to foretell what will befall thee. Thou'lt meet with dire misfortune soon, alas. 'Tis thine own Uncle Abner, dead these many years, that tells it me. Dost believe me, sir?"

Radio Wrinkles Wanted!

The Radio Editor, Mr. Paul E. Welker, wants to hear from you, if you have a good idea or wrinkle. Make a pencil or pen and ink sketch of the contrivance, write 50 words or so of description, and mail to the Radio Editor, c/o this magazine.

"I have other word, but 'tis confusing. I see the future for thee, one and all. For thee, sir writer, you who bear the look of a hearty trencherman, I bring fair fortune. Thine Cousin Minnie, she that died in fairest infancy, watches over thee. Do not fear . . . Thou'lt prosper well.

"For thee, sir teacher——OH—OH—OWWWWWWW!!!" The sweet, medieval voice changed abruptly to a howl, a boyish howl.

"Somebody turn on the light, quick!"

It was Howdidhe's voice cutting through the darkness! And it was not coming from the chair where he should have been but from the side of the room where the radio stood!

Four hands fumbled for the chain.

"Hurry up! Turn on that light! I can't hold this bird much longer! He's slippery as an eel!"

At last someone's hand struck the chain and pulled it. Four mouths gaped open and four sets of eyes stared blinkingly with surprise.

There was Howdidhe, standing beside the radio cabinet, holding by the collar a squirming youth, who was doing his best to wriggle out of the man's grip. But Howdidhe, from many years as a magician, had muscles of iron, and wriggle as he would, the lad could not get away.

"Here is the spirit" announced Howdidhe calmly. "This is the fair Lady Rowena, and if I am not mistaken, this is also Big Chief Laughing Gas and Little Sunshine. Isn't it cute?"

The boy, who looked about sixteen, but who was very small for his age, dropped his head and stopped struggling. He was an attractive youngster, with red carroty hair and a freckled face.

"What the——?"

"How——?"

"Where did——?"

Everybody was speaking at once.

"Madam," said the magician, bowing toward the red and spluttering Lulu, "here is your spirit. I hope you find it quite satisfactory. It is a very well fed spirit, madam," he said, eyeing the round rosy cheeks of the boy. "I congratulate you on the good care you take of your ghosts."

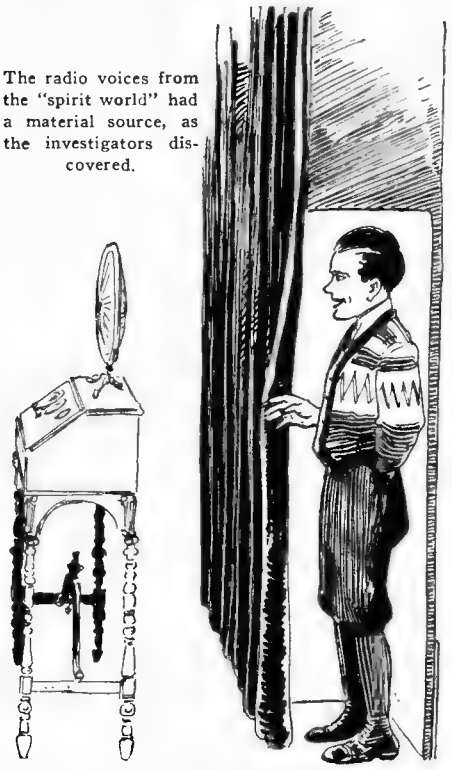
The lad looked up with an Irish twinkle in his eye, and deliberately winked at the magician.

Just then Madame Lulu decided it was time to faint. With an "Oh, my heart!" she dropped, like a sack of meal, back into her chair.

"She has fainted!" exclaimed Jeemes. "Give her air! Get some water! Find some smelling-salts!"

"Oh, she'll be all right. That's one way out of what I must admit is a pretty tight squeeze. It must have been a shock to see her spirits in the flesh," said Howdidhe.

"Tell us, how did you guess it? By Jove, she had us pretty well fooled, I don't mind saying," the professor, just beginning to get over his surprise, said.



The radio voices from the "spirit world" had a material source, as the investigators discovered.

"If madame will wake up, I shall be glad to explain to her just how I discovered her little game."

He waited. Soon madame's eyes fluttered. Slowly, weakly, she sat up.

"Oh, where am I?" she murmured, her hand over her heart.

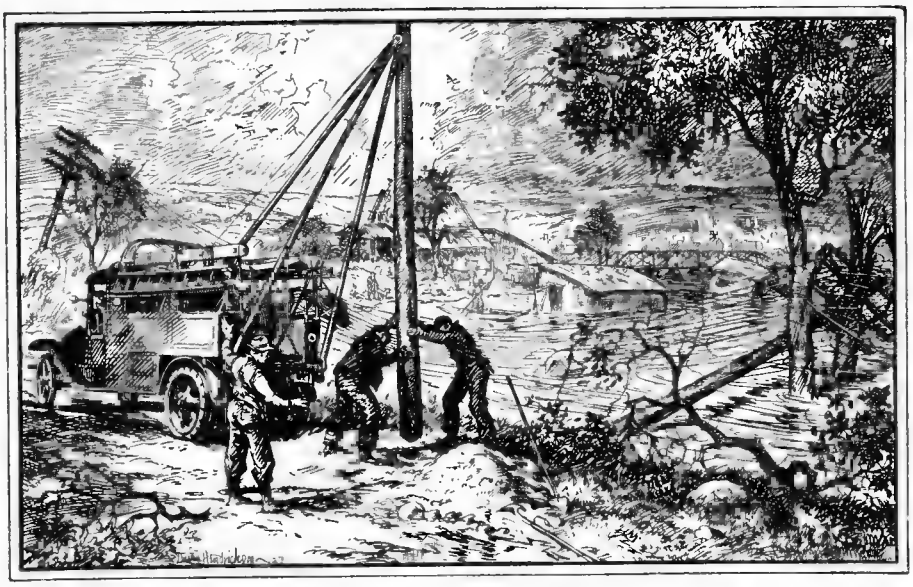
"Its all right, madame, no more dramatics, please. The game's up, I guess, but it was not your fault. Do you care to listen while I explain to these gentlemen how I found you out?

"What, no answer? Well, silence means consent."

"But how did he get here? I didn't see anything, and we could not have helped hearing him if he had come in through the hall door, since the passage outside is uncarpeted," said Jimpson in amazement.

"That's easy. You remember, when we were examining the room, we noticed that there were no doors besides the one we came through. That struck me as pretty funny, in a room situated as this one is, since there should be a door at the other end. But we examined all the walls under the hanging, you recall, and found no opening.

"Now, the wall is panelled. That gave me a clue, and the fact that the radio cabinet is



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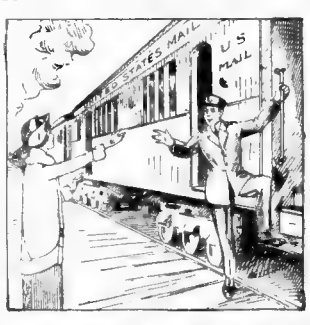

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a pretty elaborate affair gave me another.

"I was sure that the deception must be pretty clever," the magician went on, "or it would not have deceived so many people who should know better. Here is what happened:

"I noticed that just behind the radio cabinet there is an opening in the hangings, very cleverly concealed by the folds. Behind this is a panel. Look!" He lifted aside the curtain, showing a gaping hole in the wall, where the panel had rolled back like a door.

"That is how he entered. That is also why Madame Lulu sighed so loudly and long as she did, to cover the sound of the oiled rollers. But I caught it, faintly.

"You will notice that this lad is small, quite small enough to pass through the panel. If you will come around this way, you will see how he did it."

The men crowded around, leaving Madame Lulu sitting, stricken, in her chair.

"Oh!" they said, as one.

The back of the radio cabinet, like the panel, was slid back on rollers, leaving a compartment to project the voice through.

"Do you see? This can be controlled either from the inside or the out. I have used the same contrivance many times on the stage.

"Say, sonny," he said, turning to the boy, whose collar was still held tightly in his grasp. "Where did you learn to talk in so many different voices?"

"Oh, I practiced it for fun with the kids," said the boy, with an impish grin. "And I been reading King Arthur. That's where I got that Lady Rowena stuff.'

"Hm—m—m. I see. Suppose we let Madame Lulu over here go. We'll expose her in the papers. What a story it'll make! She'll have to leave town, and she'll never dare try this radio séance stunt again.

"By the way, sonny, do you know who I am?"

"No," said the boy. "Who the deuce are you?"

"I am the great—the only—the original Thurston Howdidhe! I am the magician!"

"Ohhhh," said the boy in a hushed, awe-stricken voice.

"Yes. I am Howdidhe! But you are too good to waste. You're pretty good yourself. How would you like to join my act? I'll teach you how to be a magician."

The boy turned to the woman in the chair. "Say, mom, kin I?" he asked.

"Mom!" said Howdidhe. "What do you mean?"

"Sure she's my mother. And her name's Mrs. Maggie O'Flaherty. She's no more 'Madame Lulu' than I am, and my name's Pat O'Flaherty. This was all my idea anyway, but we sure cleaned up big while it lasted."

"Well, another good ghost gone wrong," said Coyle sadly. He was very much disappointed.

Articles In September "Radio News"

Awards of the $300 "What's Wrong With This Picture?" Contest.
Socket-Power Operation—A Comparison of Methods.
Adapting the Strobodyne Receiver to Loop Operation.
The Gomez Super-Reflex Receiver—a Blueprint Article.
A Prize-Winning Portable Super-Regenerator.
The Moduloscope—By John L. Reinartz.
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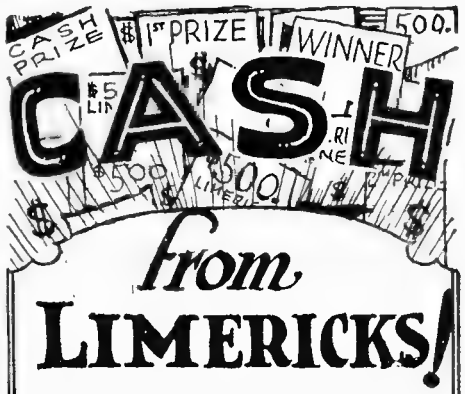
Experimental Detection, by L. W. Hatry.
Radio's Will o' the Wisp—a Resumé of "Static-Eliminator" Patents.
Ultra-Short-Wave Experiments in Germany.
What's New In Radio.



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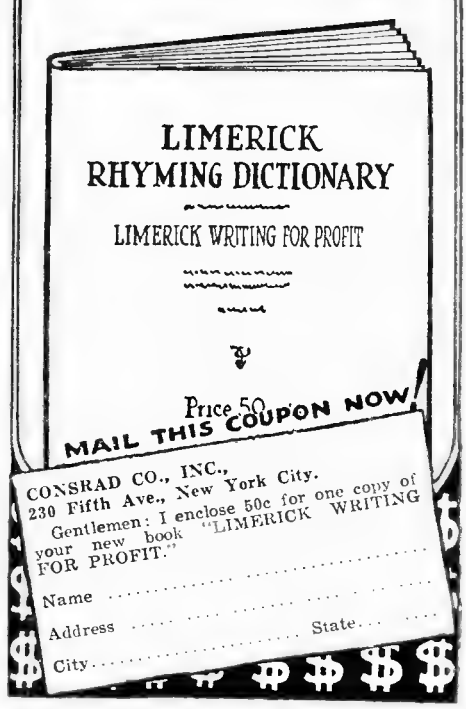

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Building a Model of the U. S. Brig of War "Truxton"

By WILLIAM A. CROSBY

(*Continued from page* 424)

four pieces of wood a quarter of an inch square and fit these so that two come on each side acting as shores to hold it vertical. They may be tacked to the base board and just tipped with enough glue to hold them in against the side of the hull at the top, 12.

With the base complete, the entire inside of the model should be given two good coats of white shellac to keep the dampness out of the glue. Be sure that this shellac runs down well into the openings between frames and alongside the keel.

If you wish, you may put in a lower deck next, by using a piece of the cardboard cut to shape from the sections in the line drawing. This is done by laying off the correct distances between the sections on the cardboard and then, from the body plan, take off the horizontal widths at each section. This may be done with a strip of paper, but when you cut the line, make it just a trifle smaller because you are taking off for the thickness of the frames.

If you put in this lower deck cut holes in it about amidships which will be the hatchways by which the hold may be reached. In the writer's model even little ladders lead down through this hatch to either side of the keel. The ladders were made from smooth match sticks with pieces of the mahogany colored cardboard across them for steps. The entire ladders should be shellacked before being put into position.

The main deck cannot be put on until the places for the lower ends of the masts have been taken care of. Locate, from the plan, the exact spot where the center of the two masts come 13, by measuring from the stern. Mark these spots on the lower hull exactly in the center of the keel. Drive a pin into each of these spots and then remove it with a pair of pliers. This will give you the hole for what comes next. Take two good sized pins and cut off the heads. Then file a rough point on this end and after putting a small drop of glue on the end push the bluntest end of the pin into the hole you have just made in the keel. Allow about three eighths of an inch of the pointed end of the pin to extend upwards so that when the masts are put in, the ends may be pushed down over this point.

Notice that the masts rake toward the stern a little and when you make the holes through the main deck allow for this.

The main deck must be heavier than the other and it is started with a good heavy piece of cardboard such as a pad back. Try to get a piece which is large enough so that it will be all in one piece. From the line drawing, (sections), you can secure the contour of this deck just as for the lower deck. Before it is put into place, a strip of cardboard should be glued to the inside of the hull at the point where the lower side of the deck will come.

Secure a piece of smooth drawing paper and on this rule parallel lines parallel to each other and about one-eighth of an inch apart. You can make these in pencil or in waterproof ink, but in any event make them just as neatly as you can and also have them evenly spaced, for this is the real deck and unless it is a good job it may spoil the whole model. This piece of paper is glued to the upper side of the cardboard which has already been cut to the shape desired. Locate the masts on this as outlined before and cut holes a little over a quarter of an inch in diameter so that the masts can go through.

One inch astern of the after or main mast, cut a square hole in the deck for a hatch.

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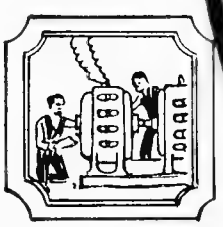

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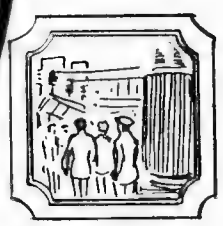

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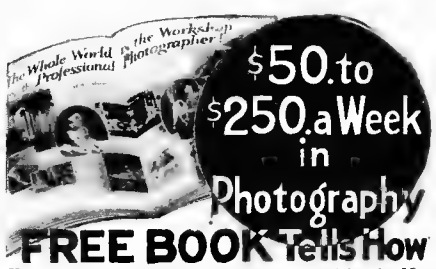

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This will be about three-quarters of an inch square. Just forward of this same mast (about three quarters of an inch), cut another hatch hole which will be about an inch and a quarter square. Another hatch goes half an inch forward of the foremast. This is for the crew's ladder to the forecastle and the opening is about half an inch square. Be sure that all of these hatches and the masts center up exactly on the center line of the ship. With these holes in place, the deck is ready to go into position where it is firmly glued to the pieces which have been previously fastened to the inside of the hull. The upper edge of this deck should be about one-sixteenth of an inch below the lower edges of the gun ports.

Around the edge of each hatch a narrow strip of cardboard is glued so that it raises the actual opening above the level of the deck. This is called a coaming and the hatch may be made to fit down over this. The center hatch, or main hatch, is fitted with a square cover which lifts off entirely, 14, but the other two hatches have paper hinges on their forward edges so that they will hinge up. If you wish to go into great detail you may arrange a hasp-like structure on each side of the main hatch by which it may be secured down to the deck.

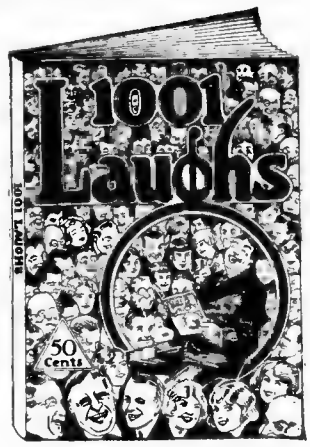
All the way around the outer edge of the deck we have what is called a water-way. This, in reality, is simply a narrow strip of the mahogany colored cardboard, possibly three-eighths of an inch wide, glued to the deck so that the outer edge is close up against the side of the ship, 15. Contrasted with the white decks, it will make a pleasing appearance. Strips of the same cardboard are glued to the deck about each of the hatch openings. As soon as these pieces are glued to the deck give it at least two coats of thin shellac so that the white part will not become soiled. Take care to keep it clean all during the construction of the ship because a dirty deck will do much to spoil the appearance of the finished product. The deck should be "gleaming white."

The inside of the rail, that portion of the frames and planking which comes above the deck, must have something to cover it up.

In real ships this is called sheathing and for our purpose we will use a strip of cardboard cut so that its lower edge fits snugly along the deck. This strip is laid up inside the rail and on the outside the gun ports are marked off, 16. The "sheathing" is then removed and the openings cut after which it is glued in place, one strip on each side of the vessel. This will cover a part of the waterway but there will still be some of it showing. The sheathing should be painted white.

The rudder should now be fitted. This is made to the shape shown in the drawing, cut from a thin piece of wood and to secure it to the hull at the stern, thin pins are bent in the shape of an "L" with the pointed end driven into the forward edge of the rudder and the "L" part arranged to point downward. These form hooks which are put into little eyes in the sternpost, 17. The eyes are made by cutting off a piece of picture wire, about an inch in length, and then, with a pair of pliers, removing one strand of wire at a time. This will give you the fine wire which will be used extensively throughout the model.

The eyes are made by taking a hat pin and making a loop about it then turning the loop up tightly with a pair of pliers and cutting off the excess wire with wire cutters. The entire length of the eye and shank will be about one-quarter of an inch, 18. A hole is made for each with a pin and the eye pushed in with a drop of glue on the end so that it will stay there. These two eyes are placed in the sternpost so that they will take the hooks on the rudder permitting it to swing from side to side. It



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may be necessary to cut away a little of the wood in the rudder just below each hook so that it will fit up snugly to the eyes.

The top of the rudder has a "tiller" driven into the end as shown. This is really a wire and the slot which has already been cut in the stern is there so that this pin will pass through and come out inside just above the level of the deck. When this is complete the rudder is finished and may be left hanging in position.

The steering gear is next made. This consists of a wheel with spokes and handles, a drum and the supports. Everything but the supports may be made from the cardboard, mahogany colored preferred. The wheel is made by cutting two circles of the cardboard and fitting six spokes through them, one circle on each side. Through the center of this a rather heavy pin is passed and glued to the wheel. One of the supports is placed on next, then the drum, (glued to the pin) and finally the other support. The drawing, 19, shows the construction. This entire structure is glued to the deck with the wheel forward and with the after support about one and a quarter inches from the stern. Out near the sheathing at the extreme after end, on each side, make and put in place two more of the little eyes as outlined before. Two more will be placed at the sides of the deck directly opposite the drum of the steering gear, one being just a trifle further forward than the other. These four eyes are placed in pin holes through the deck and glued securely.

The steering line is made of linen thread and it should be strong because when completed it will not be possible to get at it again without removing a part of the model. Allow plenty of material, about two feet, and after finding the center of this, knot it and glue it to the end of the tiller where it comes over the deck. Be sure that it is absolutely secure for you don't want it to pull off. One end of this is passed through the two starboard eyes and the other end through the port eyes and so to the steering drum. Put the rudder over to one side, the string which runs the other way is knotted to the drum. The steering wheel is then turned slowly so that this thread is wound up and the rudder is brought over to a similar angle on the other side. Now knot the other end of the thread to the drum. Then by turning the steering gear, you can make the rudder move from side to side, but don't strain it too far over. The total movement of the after edge of the rudder should not be more than one-half an inch. If you can get some very fine chain secure it to the after edge of the rudder just above the water line, and lead the two ends to the starboard and port sides of the stern so that the rudder can only be turned so far. You will have to make two more of the wire eyes to hold this chain to the stern and the center of it is secured to the rudder by means of a small pin, cut off and bent over the link of the chain which happens to be the center.

When you are certain that everything is in good shape, then cut a piece of square cardboard just large enough to go across the two steering gear supports and bent by hand, to conform to the top, before it is put into place. This will be glued in place and will cover up the drum and cords.

A "grating" is made to go across the stern of the vessel so that the tiller is covered as well as the wire eye bolts. This grating should be made carefully by taking a piece of white paper and ruling it off into squares, each line being not more than one-eighth of an inch from the next one. By looking at the sample of grating shown in the drawing, 20, you will get an idea of how it is made, not like a checkerboard in spacing, but with every other square blackened in. Good waterproof ink will be excellent for this work as well as the lines which were made on the original deck.

(*To be Continued*)

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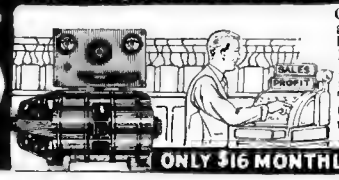

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To the Moon via Tunnel

(*Continued from page 395*)

just as the Wright Brothers did at the beginning of aviation, i. e., the starting and the flying. They figured out a wheel of immense diameter to whose circumference a projectile-vehicle was attached, in which the explorers were to go. This wheel was put into progressive rotation so as to reach, at the end of a certain time, the *optimum* speed of 40 to 50 turns a second, at which time the projectile charged with requisite initial velocity would be liberated. But it is to be remarked that the sudden departure of a projectile at so great a velocity would infallibly kill the bold inventors who would be shut up within it. The inertia of a mass which is suddenly started into motion produces the same effect as the sudden stoppage. Thus if the speed should be 7 or 8 miles a second, the acceleration so as not to kill the experimenters, should not exceed 6 yards a second and it would require 2,400 seconds or perhaps an hour, the speed constantly accelerating, before the rate would be attained for the release and departure of the projectile. And you still do not know how the traveler shut up in the metal case would stand this hour of whirling.

THE IMPRESSIVE CIRCUIT THROUGH A TUNNEL

THE process would seem at first view practical, although the inventors contemplated the necessity of a wheel for the projection of such a diameter that its construction would cost several millions of dollars. But they did not seem to take into sufficient consideration the effects of centrifugal force, developed on the periphery of a wheel of over a hundred yards diameter, a force so great that it would certainly wreck the whole affair. It does not seem likely then that this system will ever be carried out, but it can be modified and made possible in reversing the relations of the problem. Instead of having the projectile one with the projecting apparatus, it can be liberated from a motionless part. In this way we get rid of the more insurmountable difficulty and the apparatus can be conceived of in the form which we will now describe.

The rotating wheel is replaced by a circular tunnel with two concentric rails, hermetically closed in which the air is rarefied by powerful pumps, so as to diminish the resistance to motion within it. The projectile vehicle is carried on a track without wheels, sliding in the rails on articulate skates. Oil is injected under high pressure between the skates and the rails, so as to get rid of nine-tenths of the friction. And the traction of the vehicle is obtained by the Dulait-Zelmy system called Tangential Traction, through the use of a *stator* placed between the rails and a *rotor* carried by the car.

By giving diameter of some 12 miles to the circular railroad, the centrifugal force will be 400 times less than in the case of the wheel, as proposed. The car having to make a turn in 5 seconds, instead of 80 turns, to reach after 1 second the necessary speed of some 15,000 yards,. which will be reduced about 25 percent when it issues into the air.

But thus left to itself, the projectile would remain an inert body whose trajectory could not be changed, but nothing prevents the installation of a reaction motor within it, acting on the principle of the rocket and discharging by tubes opening at different points on the surface in front, in the rear and on different sides; gases, whose escape will drive the body in the opposite direction. The volume of the mass expelled would diminish evidently with gravitation, but the

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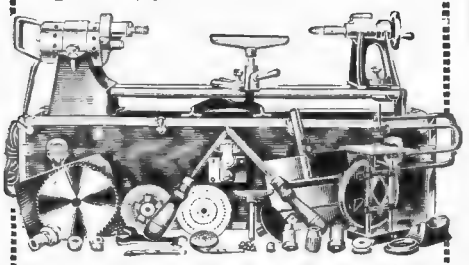

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energy developed by the escaping gases would not change in a vacuum. The force required to bring about the displacement need only be inconsiderable, because the attraction diminishing with the square of the distance at the point where the two zones of attraction of the two celestial bodies come together, that is to say, 50 radii of the earth, this attraction is so reduced that weight would be only about one-four hundredth of what it is on the earth.

THE PROJECTILE IN SPACE

ONCE we accept this way of discharging the projectile, after it has attained the proper velocity on the circular railroad, it is orientated on a straight line in the inverse of the rotary movement of the earth and at a proper inclination for it to escape most rapidly from the action of gravitation. It will then fly through space, following an oblique line, its speed diminishing as it leaves the earth behind it, the velocity will become zero when it penetrates into the sphere of attraction of the moon, after 83 hours of travel, say in three days and a half. It will then start on an elliptical course around this body, to return to earth in the same time and with the same speed, which it had when it started.

If the projectile has to carry three observers, it must be provided with food and respirable air to last through the voyage. A liter of liquid oxygen, now made on the industrial scale, will furnish 800 liters of the gas and as a man only consumes about 600 liters in 24 hours, 25 liters of liquid oxygen, a liter being a little over a quart, would be enough for the normal respiration of three men during 10 days. The carbonic acid gas exhaled, as well as the vapor of water, would be absorbed by well known chemical substances, potassium hydroxide and calcium chloride.

The best form to give to the projectile would seem to be that of a very bulky cylinder containing a central room, at whose ends the mouths of the tubes for expelling gases acting as a brake or for increasing its speed if necessary, are open to the air. The shell of aluminum alloy will have a double wall on the Dewar principle as applied in thermos bottles, so as to avoid the loss of heat during all the time the projectile is exposed to the cold of space, calculated at nearly 273° below zero Centigrade. This is in the neighborhood of the absolute zero.

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WE have only sketched the principal outlines of a project which will be carried out some day as we firmly believe, and we have done this to show that this "anticipation" can be carried out today. All that the process will permit is a view at short distance of the world which accompanies the earth in its travels around the sun, but not to reach its surface because there would be no way of getting back, unless they had a reaction motor of great enough power to start them off from the surface of the moon, where the weight is 6 times less than on our planet, but we have no idea of how to make this motor as yet.

However this might be, we can feel humanity is not condemned to rest forever attached to this globe and it seems that its destinies are more exalted. The moon is only an annexed province of our world and it has to be conquered. It is in the order of things and a day will come when this will be recognized as necessary. We have shown that the thing was at least possible, and our conclusion will be that some such exploration will be the great achievement of our future humanity for we cannot imagine or foresee what unknown benefits will result from this conquest of the nearest world to us, which we only know at the end of our telescopes.—*HENRY DE GRAFFIGNY* in *Je Sais Tout.*

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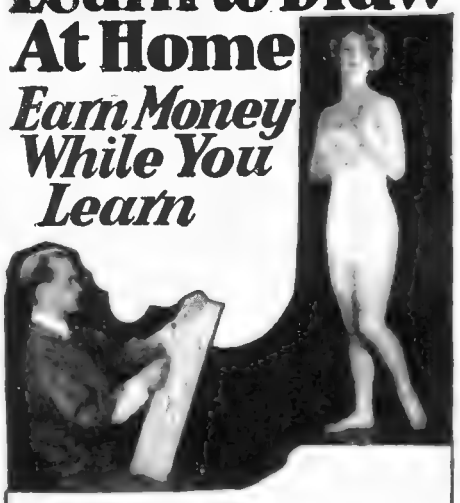

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Readers' Forum

(*Continued from page* 434)

In every issue of SCIENCE AND INVENTION magazine, plans and specifications for the models that won cups are given. Blueprints of the model are also always available from the Model Department of this publication. Let us hope that the small change will please all of our readers.—EDITOR.)

PALMISTRY

Editor, SCIENCE AND INVENTION:

My hat is off to you for your exposés of spiritualism, Hindu Fakirs, astrology and fake medical cures. Now tell us, is there any real scientific truth in Palmistry?

AN S. & I. BOOSTER,
New York City.

(Just what do you mean by "Is there any real scientific truth in Palmistry?" Palmistry itself is based primarily upon the law of averages. If the majority of red haired people have violent tempers, we might predict that the red haired person will develop such a temper. As the result of this prediction, the odds would be in our favor. The same is true of a game of cards. The royal flush is one of the most difficult hands to obtain. Hoyle states that one royal flush is produced in every 649,739 hands. It is not necessary that one play so many hands of cards before getting a royal flush. Perhaps the player will sit in the game for the first time in his life and get one.

Now, harking back again to the subject of palmistry, if most people who have certain line figuration, possess various attributes, then the chances are that others with the same figuration will also possess those self-same attributes. There are many other factors that might be taken into consideration and might change the fortune of the individual, but the palmist can merely make a guess at the possibilities. Were you to go to a fortune-teller to have your hand read, you would find that you most strongly remembered the things that pleased you and seemed to be truthful and also those that are decidedly distasteful. All other statements are quickly forgotten. You might then assume that the palmists possess some remarkable powers and even believe that there is considerable truth in the art.

A palmist can obtain more information from the shape of the hand than from the lines thereon. Every physician will tell you that even the nails tell their own story; for instance the white spots on the nails indicate injuries, cardiac and pulmonary diseases leave their traces, and transverse grooves and pits tell of continued fevers. Brittleness, splitting, pits and grooves also are frequent in pneumonia, scarlatina, influenza, acute rheumatic fever and erysipelas. Atrophic changes are part of the symptoms of metallic poisoning in the cases of arsenic, lead, mercury or silver. The same changes occur in diseases in which nutrition is affected, such as diabetes mellitus, gout, etc.

Similar effects are also found in the hands of persons and a good palmist can tell as much about a person from his hands as a character reader can tell that same person, by analyzing his face. In either case the future fortune is purely a guess. One might predict severe illness if the person developed that so-called "Hippocratic nails," commonly seen in tuberculosis. To predict "lingering illness and death," basing the prediction on this sign, would be foolish. An auto wreck might do the job quicker.

So you see there is something in palmistry but it tells of the past, not the future. A heavy "life line" shows marked flexibility of the thumb and hence infers powerful physique. This in turn implies a state of good health, of long standing. —EDITOR.)

SUBMITTED AN ARTICLE

Editor, SCIENCE AND INVENTION:

I have been a reader of the EXPERIMENTER and later SCIENCE AND INVENTION for a number of years to the tune of about sixty dollars. During that time I have derived much pleasure and received much knowledge and after many years, I feel I have a right to register a kick. Several issues back I began to look for an article I sent to your publication as a contribution. It was a description and picture of a pipe line painting device "Patent Applied For." The machine has brought a great deal of favorable comment, it is a meritorious and successful article. I felt quite proud of it and therefore felt it would not be a disgrace to the prestige of SCIENCE AND INVENTION. As no mention has been made through the magazine, is it possible the reason is because I am not a scientist or a professor?

JOHNO S. HILL,
Arkansas City, Kansas.

(It is very difficult to try to explain to our readers the reasons for not using all of the material which comes to our attention, but if our

(*Continued on page* 466)

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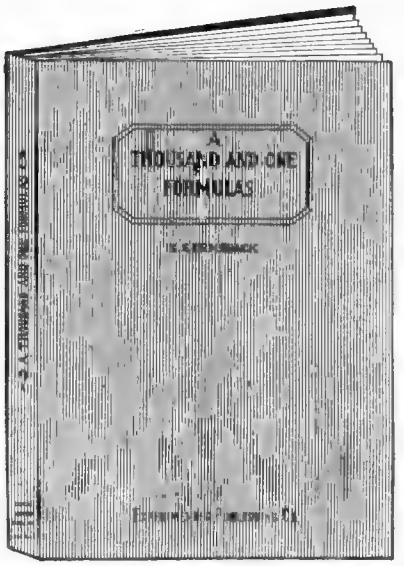

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Readers Forum

(*Continued from page* 464)

authors would take the position of our editors, they would quickly see the answer themselves. Just assume for one moment that you have 50,000 reporters, reporting for you and that only a tenth of all the articles submitted are available. You are then deluged with 5,000 manuscripts all of which you must read and consider and only a few of which you can use in a magazine of this size.

This publication could publish ten magazines of the size of SCIENCE AND INVENTION, if they were to use all of the available material which arrives, omitting unavailable or old matter. Occasionally articles will be held for months awaiting publication before space permits their use.

We certainly regret that your article (and this statement goes for all of our other contributors) has not found its way into the pages of the magazine.

The editor was once a humble contributor himself and he knows how the contributor feels when he receives a rejection slip.

A public school student, or for that matter, a person who has not even attended school, has as much chance with his article as a college professor, but unfortunately for the average student, the explanation rarely explains, and the article itself is not always worth while. When once the "knack" of writing for any magazine is obtained, articles are accepted in such rapid sequence that the author often wonders in what way his previous material was defective.—EDITOR.)

A Ship That Swallows Whales

By C. McKNIGHT SMITH

(*Continued from page* 399)

day, for about three months. The whale hunting season lasting from December to March, the summer of the antarctic regions, and in some instances means the refining and storing of 48,000 barrels of oil; 31.5 gallons to a barrel, a total of 1,512,000 gallons abstracted from 530 whales and valued at a round million dollars.

Comparing this scientific whaling with the old methods we find that in a period of three months these two modern whalers the C. A. Larsen and the Sir James Clark Ross have accomplished what two or more of the old time lumbering, bluff bowed, square riggers, with their long oar-propelled hunting or "Killer" boats with men harpooners took voyages of three years to do, often entailing the loss of men, boats and ships.

HUNTING THE WHALES

Having described the methods of stripping the blubber and extracting the oil from the whale carcass and its ultimate disposal, let us go back and join the mother or depot ship in the first part of December when it reaches Steward Island, south of New Zealand.

Arriving there the ship is joined by six 200 ton "Killer" boats armed with harpoon guns; these boats being the actual hunters.

The fleet then starts for the hunting ground which is the Bay of Whales, in the Ross Sea, 2000 miles south of New Zealand and about 700 miles from the south pole.

It is said that it was Captain Amundsen who, so to speak, tipped off his countrymen to the excellent whaling conditions in this locality, which is bounded on the west by Victoria Land, on the south by the Great Ice Barrier and King Edward VII Land, on the East by unexplored territory and on the north by New Zealand and the open sea.

Troughing through from three to five hundred miles of ice pack from three to six feet thick the hunting grounds are reached after a voyage of from two to six weeks and the "Killer" boats start the hunt in zero waters.

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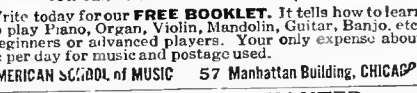

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plodes after the harpoon has been shot into the whale. When struck the whale either dives or starts a "run." These runs often attain terrific speed and sometimes a large blue whale will tow a "Killer" boat with its engines in reverse speed of 8 knots at from 10 to 15 miles an hour for miles until it becomes exhausted and dying.

As soon as the whale is dead it is hauled alongside the "Killer" boat and a long sharpened nozzle on the end of a hose connected with a compressed air tank is jabbed into it and the whale is inflated so that it will not sink and be lost after the kill.

This operation is employed when more whales are in sight, and a pole with a red flag is stuck into the inflated carcass and it is left to float while the chase is continued.

When the big fish are abundant a "Killer" boat will often get several, towing them to the depot ship where they are lashed alongside to be disposed of in turn by the operations and methods described.

How to Make a Magazine Holder

By H. L. WEATHERBY

(*Continued from page* 413)

pairs together, such as the two ends, the two fronts, and the two partitions; and saw them at the same time. This will prove to be rather a difficult feat if performed with a small compass or coping saw, so it would be better to saw the pieces separately if cut out by hand.

Now file and sandpaper all curved edges and hand holds, and round slightly the sharp corners around the curves.

We are now ready to assemble the parts. This calls for rather skillful nailing, since a brad driven a little off center or crooked will surely come out, either on the inside or outside of box. Do not nail the two partitions into place until later. If they are fastened into position at this time it will prove to be very hard to do a good job of painting the inside of the magazine holder.

Next, paint the inside of the rack and the two partition pieces with two coats of lacquer, or with a flat undercoat and two coats of enamel. If lacquer is used, the two coats may both be put on inside of an hour. When the paint is thoroughly dry nail the partitions into place, set all nails, fill nail holes with putty or filler, round all outside corners slightly and sandpaper thoroughly, and the outside is ready for painting. Paint as the inside was painted, being very careful to flow the lacquer or enamel on, so as to do a smooth job. Never attempt to brush lacquer out, as it dries too quickly and will show brush marks.

When the paint has dried, with a little bronzing powder in solution, go over the curved edges on the center partition, the top ends of the other partitions and the two end pieces; also the edges of the opening in the center partition.

Now, as a final touch, and the magazine rack is complete, add a "Decalcomania" transfer to the two fronts. These transfer designs come in a wide variety of patterns and are easily applied, the method being as follows: if duplex paper, or double thickness, split at one corner about ¼-inch, paint over the thin paper side with varnish and allow to set until varnish becomes very sticky or about five to ten minutes. Now place the design in place and press tight, being very careful to center up correctly; remove the thick paper back and press or roll the thin design paper out smooth, being careful to squeeze out all air bubbles, and taking care not to injure the design. Then, with a piece of absorbent cotton soaked in water, wet thoroughly the paper back of the design until it loosens up and is easily removed. The excess varnish can be re-

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Ford had nothing in his favor except an "idea." Steinmetz was never a robust man. Edison's path was not strewn with roses by any means. Yet, in spite of all obstacles, these men made their ambitions come true because they had the WILL TO WIN. No matter how discouraging your present circumstances may be, you, too, can rise above them.

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moved with cotton soaked in gasoline or turpentine, patting around the edges of the transferred design rather than rubbing. After the designs have set for twenty-four to forty-eight hours a coat of varnish may be given them as a preservative.

Natural or Cultivated Pearl — Which?

(*Continued from page* 405)

such a little bead with layers of pearl surrounding it (Fig. 1), using a proper source of light and turn the pearl about, relative light and darkness at an angular distance of 90 degrees should appear in alternation. Experience has shown that certainty with this method is only attained when the outside layer of pearly matter is thin.

Another way, due to von Michel and Riedl in Vienna, rests on the visual recognition of the division between bead and pearly layer. But this test can only apply to perforated pearls and requires a special apparatus whose principle is shown in Fig. 2 in diagram. Into the perforation of the pearl a rod, S, is thrust which is smoothed off and flattened and polished at its top to form a little "periscope." With the help of the microscope, M, and the little "looking glass," the wall of the perforation can be searched and the junction of bead and pearl matter can be discerned.

In recent years, in the Mineralogisch-petrographische Institute of the University of Frankfurt, Dr. R. Nacken and Dr. G. Jaeger have carried out tests that in a striking way indicate the true pearl, whether it is perforated or not.

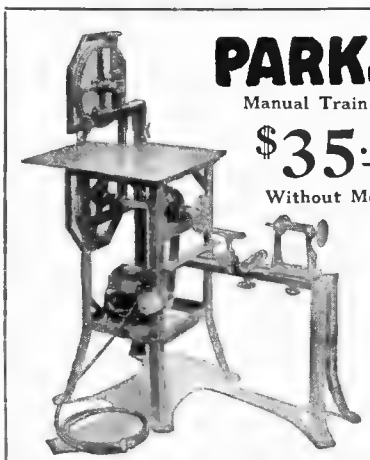
The new tests are based, exactly as are the ones already known, upon the detection of the parallel layers of mother-of-pearl in the central bead by the aid of magnetism.

The mother-of-pearl bead has the characteristic that, in the field of force of a strong magnet, it so places itself that its layers take a position parallel with the lines of force.

If one brings a mother-of-pearl bead in a very delicate suspension in a proper position between the poles of a magnet, it turns around until the layers are parallel to the lines of force (Fig. 3A and 3B). This appearance is so characteristic for the bead of mother-of-pearl that it is perfectly adapted to its detection.

So here we have a convenient and certain distinction obtained; if a round pearl in the magnetic field remains indifferently in any position without motion, there can be no mother-of-pearl bead within it. Any effects of the drilling or the form of the pearl (button pearl or barocque pearl) are extremely slight and can be compensated for by proper construction of the apparatus.

The apparatus as it is used for the tests is shown in Fig. 5 in diagram and is reproduced in Fig. 6 from a photograph. Its distinguishing feature is the powerful electro-magnet, M, and the suspension apparatus for the pearl. This consists in a system of two glass tubes, which can be separated one from the other, which secure the suspension from vibrating as well as its protection from drafts of air when all is ready for the test. The suspension consists of a fiber from the silk worm cocoon of proper thickness, C, with a glass thread carrying an index finger, Z, and the eventual pearl suspension Ptr. The method of test is simple. What we have called the pearl suspension is taken out of the apparatus and the pearl, using a little auxiliary apparatus, is stuck thereto with a wax cement. The pearl suspension is then returned to the apparatus, the suspension is made perfectly free from all influence, the current is passed through the magnet and the movement of the index is observed.—*Dr. W. Grahmann in Die Umschau.*



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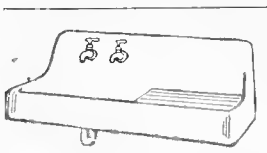

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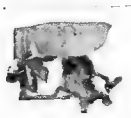

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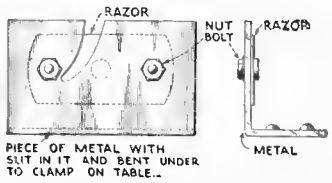
Hints for the Mechanic

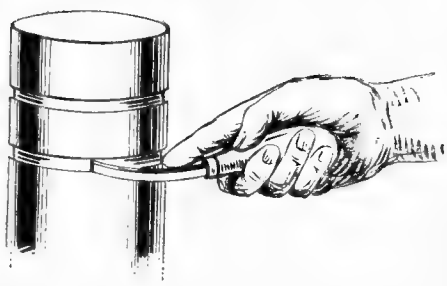
(Continued from page 431)

STRING CUTTER



A handy cord or string cutter can be made from a thin razor blade and a thin piece of metal which are fastened together.—Ivy M. Hamond.

PISTON RING CLEANER



A handy piston groove cleaner can be easily made from a piece of an old piston ring. It is ground to a chisel-like edge and is fitted with a wooden handle.—L. C. Ferguson.

COOL PAINTING

The task of painting in hot weather can be greatly lightened by using an electric fan.

RADIO TOOL HINTS

Above we have a view of a new radio tool kit which contains all the necessary tools used in radio work. The drill is shown in use.

(Continued on page 471)

Strongfort Puts Pep Into the Weakling

STRONGFORT
Builder of Men

It's the man with the punch who battles his way to the front in life—he's the chap who gets on, is sought for the good jobs, and is respected and admired wherever he goes. You needn't be a pugilist, or a wrestler, or a professional athlete. You can be just an every-day fellow, like Lindbergh and young men of his type—with plenty of sand and courage, and manly strength and vigor—to stand out in the crowd and carry off life's prizes.

You can attain strenth through Lionel Strongfort's scientific muscular development—internally and externally — and vigor and health and a full-functioning body comes as sure as sunrise!

Throughout the years he has devoted to upbuilding men and moulding them into fine, vigorous, muscular fellows, Strongfort has directed many in getting themselves into condition to become winners in whatever field of athletics they chose to enter. He has made other thousands powerful and developed them simply for the satisfaction that comes of being strong enough for defense in any emergency, or to command respect and admiration wherever they went.

LET STRONGFORT DIRECT YOU

Strongfort did not develop merely the EXTERNAL muscles—by physical culture, gymnasium or weight-lifting methods, but he began with INTERNAL development, which is the secret of health and manly vigor—the source of power most Instructors overlook.

Strongfort went a lot further than ordinary physical culture. He evolved the STRONGFORT COURSE which builds health, gives strength and brightens the pupil mentally. It gives scientific direction to exercise and builds up reserve power and vigor. It helps Nature function in restoring weakened, broken-down bodies and in keeping them fine and fit—not as drugs and dope do, by stimulating, jazzing and pepping-up the system, only to have it fall back into the old rut again, with all its faults and weaknesses.

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You may be one of those fellows—weak, sickly, ailing, depressed, gloomy; with no real zest in life, no desire for action or society—maybe a recluse—afraid of strong men; afraid, perhaps, to take the marriage vows; jealous of men who command admiration wherever they go because of their fine physique, their muscular prowess and manly vigor. If this is your picture, for heaven's sake, man, snap out of it! You can't afford to go on in such a deplorable state—not when joyous health and manly strength are readily within your power to possess.

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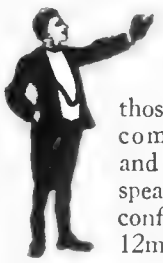

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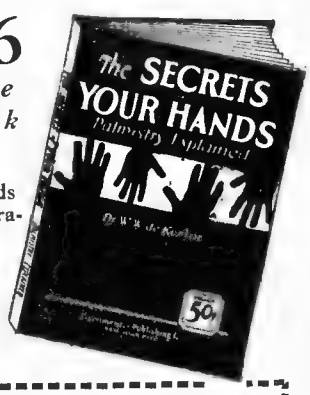

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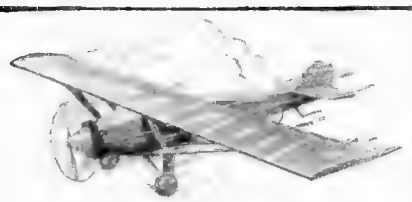

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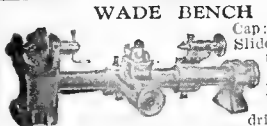

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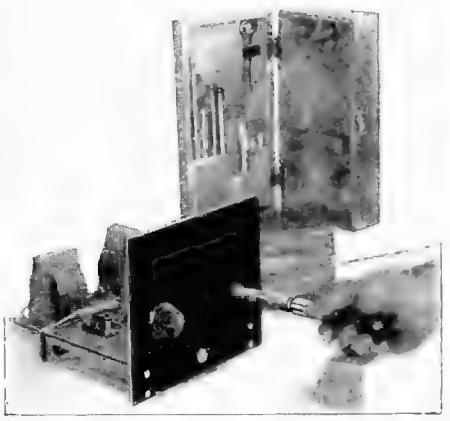
Hints for the Mechanic

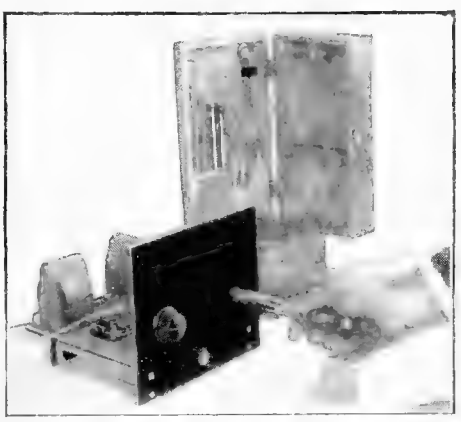
(Continued from page 469)

REAMING HOLES



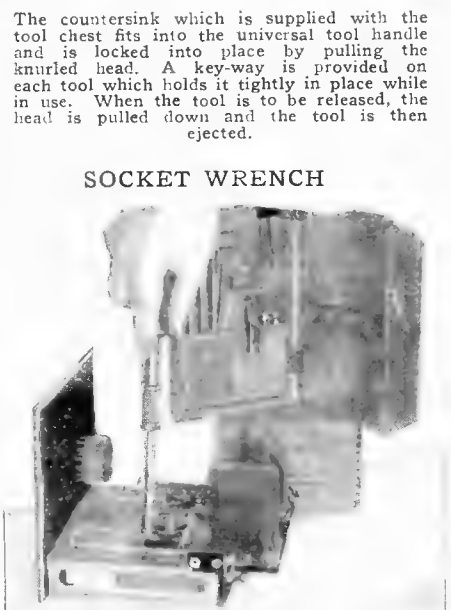
The small reamer which is supplied with the tool kit will find many uses about the home workshop, particularly when constructing a radio set. It is especially useful for enlarging holes in the panel which have been drilled for the insertion of rheostat, condenser shafts and the like. The reamer can be removed from the tool handle.

COUNTERSINKING



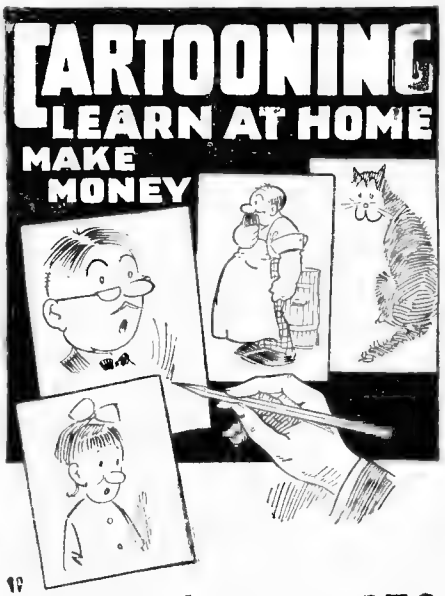
The countersink which is supplied with the tool chest fits into the universal tool handle and is locked into place by pulling the knurled head. A key-way is provided on each tool which holds it tightly in place while in use. When the tool is to be released, the head is pulled down and the tool is then ejected.

SOCKET WRENCH



Two handy socket wrenches are supplied with the tool kit. The handle is constructed from hard wood and affords a comfortable grip. The socket wrenches are useful in removing binding post nuts from transformers, sockets and rheostats.

(Continued on page 473)



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Adapting the STROBODYNE to Loop Operation

The now famous new STRODODYNE circuit, exclusive rights to which have been secured from France by RADIO NEWS, and which was completely explained with all constructional details in the August issue, is shown in this issue with special adaptation to loop operation.

The STRODODYNE is the greatest new Radio circuit in recent years, embodying a radically new system of frequency changing.

Every one using a Radio or interested in radio receiving sets should read this issue.

Gomez Super Reflex

Complete constructional information on a very unusual and interesting combination of the super-regenerative and reflex actions in one receiver is given in September RADIO NEWS.

The circuit will appeal to builders of radio receivers.

Contest Results

Results of contests on "What's Wrong with this Picture" (Cover contest) and super-regenerative circuits will be published in the September issue.

Other Features

Many other features including Socket Power methods. Beam Transmission, etc. Over 100 pages of Radio with many drawings diagrams, photographs, etc. Size of book 9 by 12 inches.

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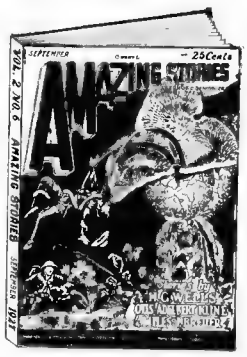

The Malignant Flower

"But even then the awful thing came to pass. The flower slowly opened, and something bright and flesh-colored shot out of it. What darted so suddenly? Was it the sucking arms of an octopus? Was it the soft arms of a woman? From Sir George there came a scream that cut to the very marrow, and John Bannister frozen stiff with fright, saw his master lifted by his shoulders, up, higher, and higher, saw him, hanging for a couple of seconds in uncertain balance, and finally disappearing slowly into the calyx of the atrocious, malignant flower, whose petals once more drew themselves together with a start."

We have given you only one exciting paragraph of the most amazing story of the month. The terrible valley of the malignant flower, the journey of Sir George, the dreadful result and his subsequent rescue will keep you in tense excitement every minute of the time. Read this complete story in September AMAZING STORIES.

The Radio Ghost

The radio instruments we know today are diverted to very odd and criminal uses which weave a tremendously exciting story dealing with a great fortune in money. A big feature of September AMAZING STORIES.

The Tide Projectile Transportation Company

How would you like to fly from San Francisco to New York in about 17 minutes? Impossible, you will doubtless say, but the thing is not half as impossible as it sounds. There is no question but that our transportation means will increase in speed as time goes on. If you had told your great-grandfather that some one would fly from New York to Paris in 33 hours, you probably would have been called a lunatic, or worse."

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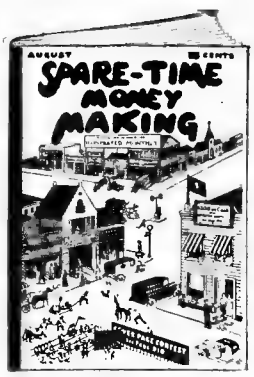
SPARE-TIME MONEY MAKING



Reader Tells How He Established Sparetime Business Netting $109 Monthly

How would you like to have $109 a month over and above your regular income? R. A. Privott of Suffolk, Va., overcame his financial difficulties with ease through SPARETIME MONEY MAKING. Adopting a suggestion from an early issue, he set out to sell a Theatre Program. With the sanction of the local theatre manager, he visited the local merchants. In one day he sold enough advertising space to realize $180 that month. Deducting printing costs and miscellaneous expenditure, the total clear profit was $109.50.

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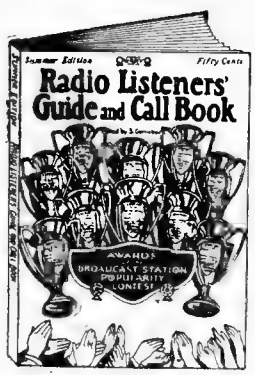
RADIO LISTENERS' GUIDE



Broadcast Stations of the World

Here is the latest book of complete information on the Broadcast Stations of the world—giving call letters, ownership, power, wave length in meters and kilocycles, and time of operation—together with space for listing dial readings.

U. S. stations are listed 3 ways. By call letters, by wavelengths and by states and cities.

Transoceanic Receiver

In this issue of RADIO LISTENERS' GUIDE AND CALL BOOK is given complete data and information on "how to build" one of Radio's great super-power receivers called the "Transoceanic New Phantom Receiver." This is an ideal set for listeners who desire good volume, clear reception at all seasons and distance when desired.

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How to Install Power Tubes

Power tubes are essential to many receivers, learn how to install them. See RADIO LISTENERS' GUIDE AND CALL BOOK—Summer Edition.

Experiments with Large Cone Speakers

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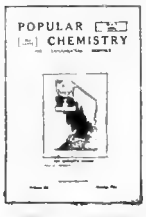

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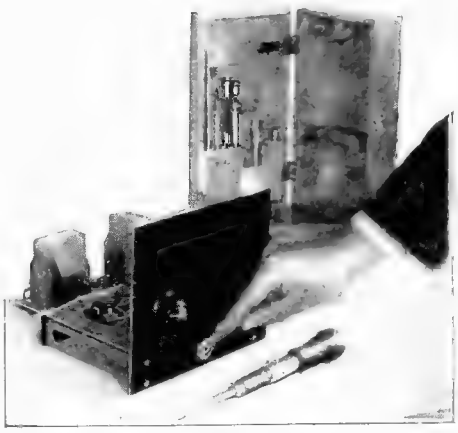
Hints for the Mechanic

(Continued from page 471)

JACK-WRENCH



The jack-wrench pictured above should prove to be a boon to the radio constructor. The wrench has been made in a standard size so that it will fit almost all of the radio jacks.

WIRE BENDER

To facilitate matters in hooking up the radio set, the wire bender, which may be seen in the above photograph, has been included in the tool kit. Several sizes of loops may be obtained with this device, which also fits in the tool handle supplied with the chest.

Photos courtesy North Bros. Mfg. Co.

A WET ENGINE

Coming South last winter a Georgia cracker showed us a mighty convenient way of handling a wet engine. Heavy rains had swollen the streams until, at one particular spot, a creek overflowed its plank bridge forming a miniature river over the highway. We hit it squarely and discovered too late that the small plank bridge had sunk down beneath the force of the water. Our speed, however, carried us partly across but the engine filled with water and stalled before we reached dry land. The Georgian directed us to "keep the engine turned off. Put her in gear. Step on your starter and let the batteries pull you out." We did and they did.

—*Malura T. Weaver.*

BOOK REVIEW

POPULAR CHEMISTRY. JULY 1927. BY J. CLINTON MOLITOR. PAPER COVERS. PRICE 10c. PUBLISHED BY POPULAR CHEMISTRY CO., SWEDESBORO, N. J.

This interesting little booklet is full of articles of interest to the chemist and to the experimenter. The series of articles on prospecting with the blow pipe should interest many. A page is also devoted each month to the latest chemical news. Elementary chemical engineering concerning the manufacture of dyes, and the utilization of ordinary corn cobs, are two of the outstanding articles appearing in this magazine for July. The Popular Chemistry book department can supply back numbers and also various books dealing with chemistry. The experimenter should find much to interest him in this small booklet, which is published every month.

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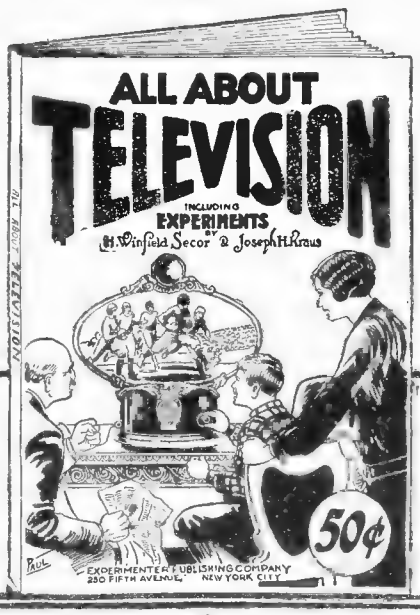

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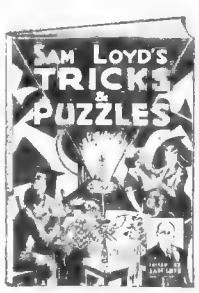

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Radio Wrinkles

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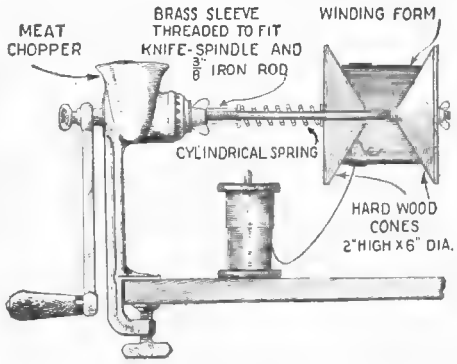
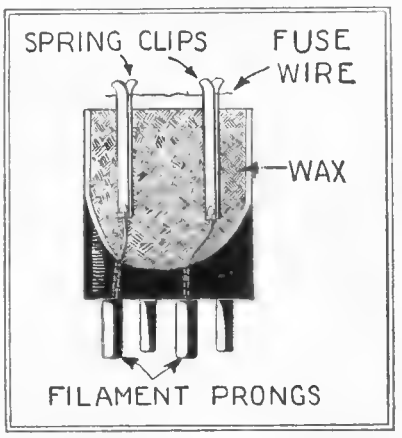

MEAT CHOPPER
BRASS SLEEVE THREADED TO FIT KNIFE-SPINDLE AND 3/8" IRON ROD
WINDING FORM
CYLINDRICAL SPRING
HARD WOOD CONES 2"HIGH X 6" DIA.

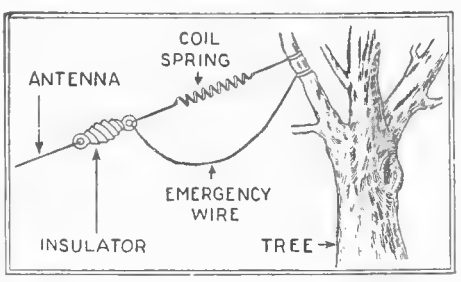
With the additional parts shown in the above illustration, the family meat chopper becomes a very serviceable coil winder. These parts consist of a 10" length of ⅛" steel rod, a 2" length of ⅜" brass tubing, 4 washers to fit the rod, and 2 hard wood cones 6" in diameter by 2" in height. The brass rod is threaded to fit the knife-spindle and the ⅜" iron rod. A 5" length of cylindrical spring is slipped over the rod and holds the winding form in place. The cones will hold coils up to 6" in diameter and 8" in length.—Philippe A. Judd, Rep. No. 7297.

CIRCUIT TESTER



A tube saving fuse-plug may be easily made with the base of a burned out or discarded vacuum tube. Remove the bulb from the base of the tube and pull out the wires leading to the grid and plate prongs. The wires leading to the two filament prongs are soldered to long spring clips. These clips are held erect with wax. A piece of fuse wire, placed across the clips, completes the circuit tester. If a mistake has been made in the wiring the fuse will "blow" and save several dollars worth of tubes.—F. M. Blackwell.

ANTENNA KINKS



The above wrinkles will save much time and annoyance. A piece of wire is looped loosely from one end of the insulator to a branch on the tree. In the advent that the original connection breaks the antenna will still remain suspended, although it will suffer a slight slack. It can be fixed then at the owner's convenience. A coil spring can also be used to advantage where one or both of the antenna supports are swayed by the wind. A spring of this nature will allow for the sway and will thus prevent the breakage of the wire. These kinks have been used by the writer to good advantage.—G. F. Stillwell.

(*Continued on page* 479)

"His Tail Between His Legs"

What most men would see if they could see themselves

MOST men are being whipped every day in the battle of life. Many have already reached the stage where they have THEIR TAILS BETWEEN THEIR LEGS.

They are afraid of everything and everybody. They live in a constant fear of being deprived of the pitiful existence they are leading. Vaguely they hope for SOMETHING TO TURN UP that will make them unafraid, courageous, independent. But it never does. They continue to work and sweat and—MAKE OTHERS RICH AND HAPPY.

Some men, however, after years of cringing, turn on life. They CHALLENGE the whipper. They discover, perhaps to their own surprise, that it isn't so difficult as they imagined, TO SET A HIGH GOAL and reach it! Only a few try—it is true—but that makes it easier for those who DO try.

What about YOU? Are you ready to admit that you are through? Are you satisfied to keep your wife and children—and yourself—enslaved? ARE YOU AFRAID OF LIFE?

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YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the November issue must reach us not later than September 15.

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Earn $8. Distribute 100 free Samples Stopleak Rivets. Send 6c stamps for samples and secure territory. Riveet Co., Cohoes, N. Y.

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Don't Sell for Others. Employ agents yourself. Make your own products. Toilet Articles, Household Specialties, etc. 500% profit. We furnish everything and show you how. Valuable booklet free. Write at once. National Scientific Laboratories, 1994W Broad, Richmond, Va.

Agents—New Plan, makes it easy to earn $50.00 to $100.00 weekly, selling shirts direct to wearer. No capital or experience needed. Represent a real manufacturer. Write now for FREE SAMPLES. Madison Company, 566 Broadway, New York.

$75.00 Weekly to Introduce "Chieftain," 3 for $4.95, Guaranteed Tailored Shirts. Full working outfit Free. Your own shirts Free. Cincinnati Shirt Company, Lane 2709, Cincinnati, Ohio.

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Radio Agents—Make Big Money—Easy! Selling Marvelous New Sets and Accessories. Buy from factory at lowest prices. Get Big New Catalog with thousands of nationally advertised bargains. FREE Call Book. Write today. American Auto and Radio Co., Dept, 278, Radio Bldg., Kansas City, Mo.

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$40.00 Suits for $23.50! All one price. Union made of finest quality Virgin Wool. You don't have to know anything about selling clothing. We guarantee your success if you are honest and willing to work. Write at once. WILLIAM C. BARTLETT, 850 Adams, Dept. 552, Chicago.

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1	
19	
8	

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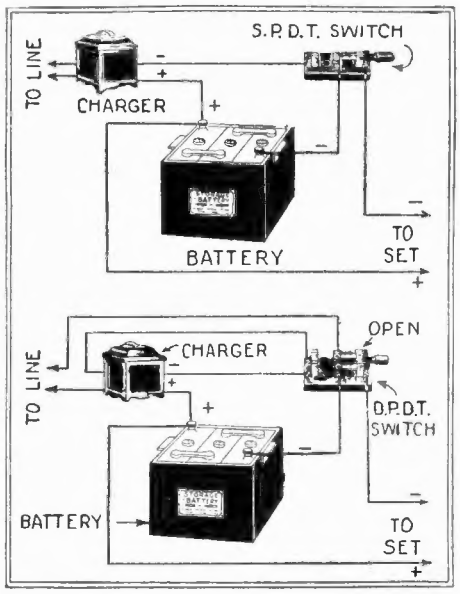
Radio Wrinkles

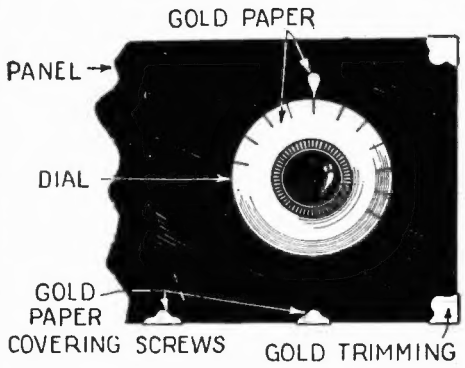
(*Continued from page 475*)

CHANGE-OVER SWITCH



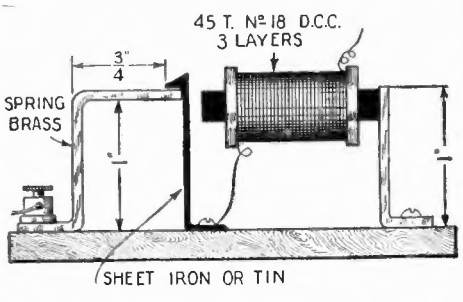
The two diagrams above show the method of using either a single pole double-throw switch or a double pole double-throw switch for disconnecting the charger from the storage battery when the set is in operation. With this arrangement the battery and charger may be placed in an out of the way position and yet the battery may be charged without disconnecting it from the set. Charging and set operation are controlled from the one switch. In the first diagram the charger will have to be disconnected from the line supply after charging, but this eliminates disturbing the battery. The above arrangements can be used with trickle or high rate chargers.—W. Swatek.

GOLD DIALS



The gold colored parts of the front cover of SCIENCE AND INVENTION may be cut up and used to cover the home-made radio tuning dials. Small triangular pieces of the gold paper may be glued to the panel directly above the centers of the dials to indicate their settings. The gold paper can also be used for a trimming around the edges of the panel.—C. F. Felstead.

HOME-MADE CIRCUIT BREAKER



The circuit breaker shown above can be used in any radio set and affords protection to the tubes. The trigger will not be attracted by the magnet when 6 volts are passing through the coil, but when the voltage is raised the trigger trips the brass spring and opens the circuit. The above illustration shows the construction.—V. D. Schurr.

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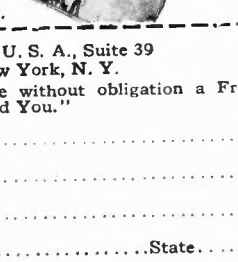

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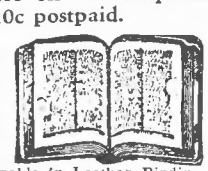

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Hold the **MAGIC INDICATOR** over a man's hand—instantly it moves in a straight line, backward and forward. Hold it over a woman's hand and it describes a complete and continuous circle. The same action can be obtained over a letter written by a man or woman, etc. It is fascinating; baffling. We have never been able to figure out how it's done—but we've never seen it fail. Many novel and entertaining feats may be performed with the Sex Indicator. For example, similar results can be obtained with animals, cats, dogs, rabbits, over birds, chickens, canaries, etc. Also used to predetermine the sex of chickens and birds, etc., in fact it is sold as a patented egg tester in Europe. **Price 25c, or 3 for 65c,** postpaid.

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With a bunce of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. **Prices, postpaid: 40 Bills 20c, 120 for 50c, or $3.50 thousand postpaid.**

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A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. Price **10c, 3 for 25c, 1 dozen 75c. Johnson Smith & Co.**

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A VERY striking and uncommon ring. Silver finish, skull and crossbone design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence its name, **Good Luck Ring.** Very unique ring that you will take a pride in wearing. **ONLY 25 CENTS.**

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JUST LIKE ORDINARY CIGARETTES. BUT SUCH REAL STARTLERS! The box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the victim gets a very great surprise as it goes off with a loud **BANG!** A great mirth provoker yet entirely harmless. **Price 25c per box.**

Popular Watch Charms

15c

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Very pretty little curiosities and decidedly novel. Fitted with Magnifying Lenses that enlarge the pictures to a very surprising degree; in fact, it seems almost incredible that a clear picture could be possible in such a small compass, and how sharp and distinct they show up when you look through. Come in assorted views—Actresses, views of Panama Canal, Lord's Prayer in type, etc.

CIGARETTE MAKER

Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs ½ oz. Made entirely of metal, nickel-plated. **Price 25c postpaid.**

MAGIC FLUTE

Wonderfully Sweet Toned and Musical

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The Magic Flute, or Humanatone, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once acquired after a little practice will enable you to produce very sweet music that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument, the effect is as charming as it is surprising.

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Kissing Permit 10c *Garter Inspector 10c*

Two very novel metal badges, nickel plated, that you can wear, giving you fun out of all proportion to their trifling cost. **10c, each badge, 3 for 25c, or 75c per doz. p.pd.**

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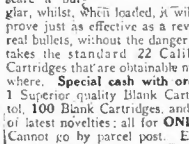
This well made and effective Pistol is modelled on the pattern of the latest type of Revolver, & the appearance of which alone is enough to scare a burglar, whilst, when loaded, it will probably prove just as effective as a revolver with real bullets, without the danger to life. It takes the standard 22 Calibre Blank Cartridges that are obtainable most everywhere. **Special cash with order offer:** 1 Superior quality Blank Cartridge Pistol, 100 Blank Cartridges, and our new 550 page De Luxe Catalog of latest novelties; all for **ONLY $1.50.** Shipped by Express only. Cannot go by parcel post. Extra Blank Cartridges 50c per 100. Special Holster (Cowboy Type) for pistol 50c. No C.O.D. shipments. **Johnson Smith & Co., Dept. 867 Racine, Wis.**

Sneezing Powder



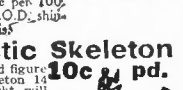
Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. **For parties, political meetings, car rides, or any place at all where there is a gathering of people, it is the greatest joke out. Price 10c or 3 for 25c**

Mystic Skeleton

10c ppd.

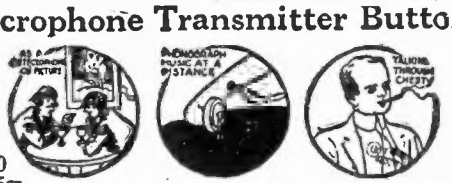
A jointed figure of a skeleton 14 in. in height, will dance to music and perform various gyrations and movements while the operator may be some distance from it.

Serpent's Eggs



Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most life-like manner. **Price per box 10c ppd.**

Microphone Transmitter Button



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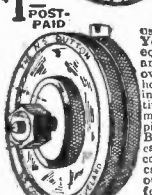

You can easily make a highly sensitive detectophone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the stage. It is ultra-sensitive and is the greatest invention in micro-phones. You can mount the button almost anywhere—beard board boxes, stove pipes, stiff calendars, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone transmitters; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the Button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. $5.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturers find it suitable for use in their literature. **PRICE $1.00 POSTPAID ANYWHERE.**

ANARCHIST BOMBS

One of these glass vials dropped in a room full of people will cause more consternation than a limburger cheese. The smell entirely disappears in a short time. **10c a Box, 3 Boxes for 25c**

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The most confidential messages can be written with this Ink, for the writing **MAKES NO MARK.** Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your postals and other private memorandums away from prying eyes. Great fun for playing practical jokes. **Only 15c Bottle**

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This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more.

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One of the most wonderful plants known. Possesses the strange power of turning in a few minutes from an apparently lifeless, dry herb to a BEAUTIFUL LIVING FERN-LIKE PLANT of a dark green color. Simply place the plant in saucer of water, it will open up and start to grow in 20 minutes. When taken out it will dry up and go to sleep until placed in water again. Fine house plant—summer or winter. **10 cents each or 3 for 25c, Agents Wanted** postpaid.

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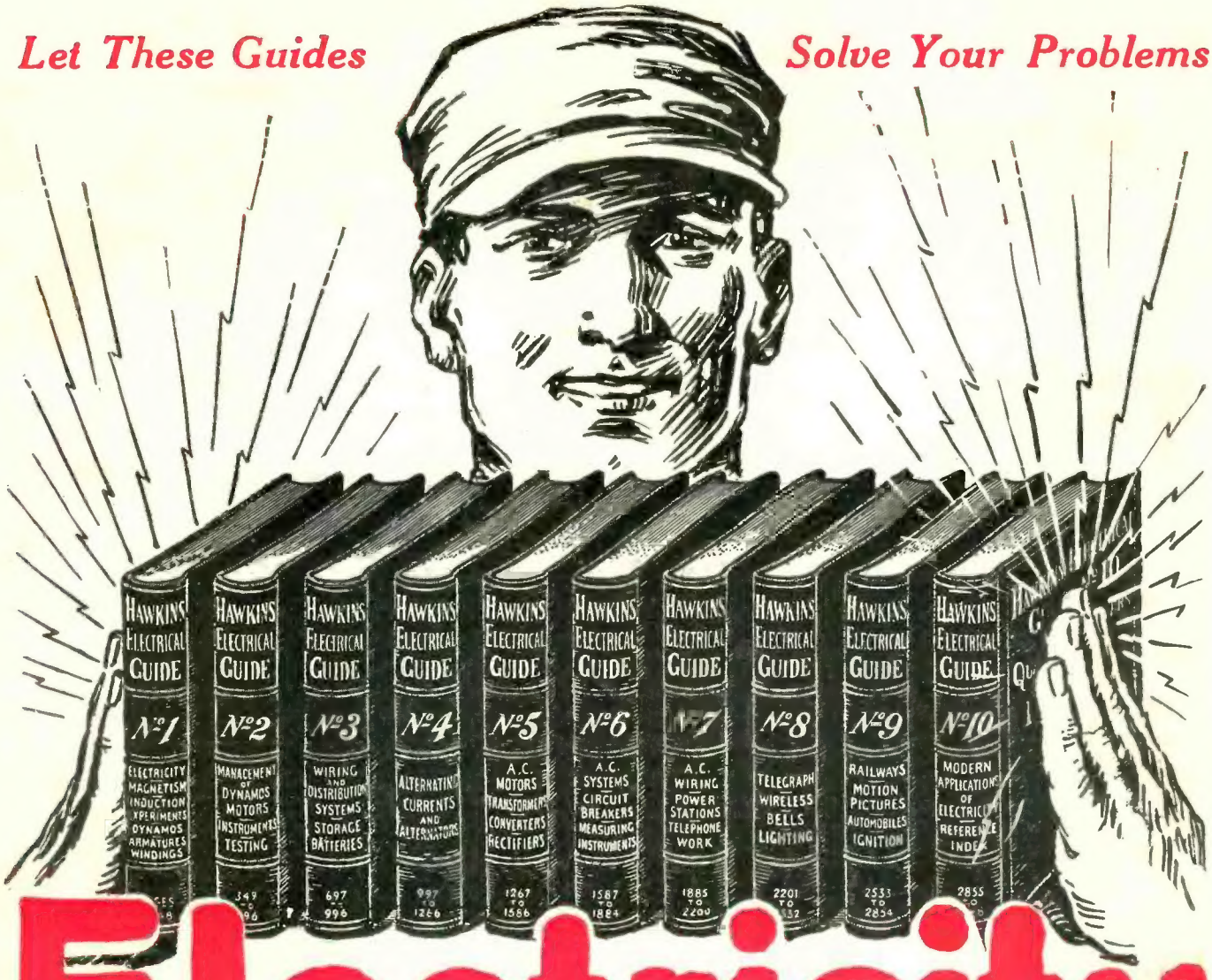

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S. I., Sept.

Handwriting Tells

A special point if you hold your pen like this. (At left.)

The "southpaw" often needs a point that's hard to find.

If you grip your pen like this—another point.

A different group of points for feminine hands.

HERE'S a brand-new Service . . . . . tested, checked and rechecked for months with literally thousands of specimens of handwriting.

Through the science of Graphology—(expert analysis of characteristics shown by handwriting)—it is now possible to select from a gigantic stock of pens the 14-karat solid gold, iridium-tipped point exactly suited to your style of writing and of holding a pen.

To fit dozens of different types of handwriting our pen point makers have developed dozens of new types of pen points which are not sold in retail stores.

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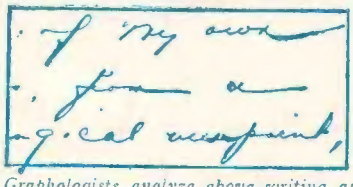
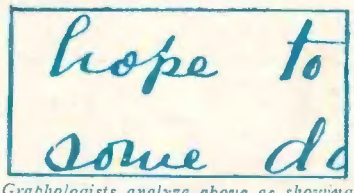
Your handwriting tells exactly what kind of point you need. One of the most famous graphologists in America has been engaged to study your handwriting and to select the scientifically correct pen point for you. This great innovation now makes buying a Postal Pen by mail the ideal way to get a proper-fitting pen. Also the economical way.

Even if the retail stores could be induced to carry in stock a larger variety of pen points to really match the many different types of handwriting—they could not carry such a wide variety as is now available to you. And you would have to test hundreds of pens to find the point most perfectly suited to your individual style of writing.



Graphologists analyze above writing as showing idealism, individuality, affection, humor and love of adventure.



Graphologists analyze above as showing business ability, caution, sincerity, jolly disposition, breezy personality.

Laura Doremus, famous graphologist, vice-president of the Graphological Society of the United States. She will analyze your writing.

This New Service Is FREE

Our new Service — Graphological Analysis of your Handwriting for the proper Selection of Pen Point—is FREE to every purchaser of a Postal Pen. If in addition you would like to know what the Science of Graphology can tell about your character, or the character of a friend, from handwriting, read text panel at left of coupon below.

The Postal Pen—Transparent—Guaranteed $7 to $8.75 Quality for $2.50. You save approximately two-thirds of the cost by buying direct from us. Salesmen's, jobbers' and retailers' discounts are eliminated. You get a pen absolutely guaranteed to be made of the same unbreakable materials as pens selling from $7 to $8.75—**and so officially proved on many occasions.**

And the Postal Pen has exclusive improvements which you can find in no other fountain pen at any price.

In the Postal Pen you can actually see your ink supply at all times. Its barrel is transparent—unbreakable. Never runs unexpectedly dry. It actually holds 3 to 4 times more ink than ordinary pens—writes three times as long from each filling. Ideal for Treasurers or others who must sign their name often or write for hours at a time.

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Where else could you buy a fountain pen on approval and return it after filling it with ink and using it for 30 days? The Postal Pen must convince you of its real superiority by its actual performance—or your money is refunded.

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Postal RESERVOIR PEN

POSTAL PEN CO., Inc., Desk 265
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For Character Analysis of Handwriting—Enclose 25c Extra When Ordering Pen

If, in addition to the free graphological selection of proper pen point, you want to know what Graphology can tell about your character and personality from your handwriting, check here [ ] and enclose 25c extra when ordering your pen. Miss Doremus has agreed to make a brief but individual and personally handled Character Analysis of each specimen of handwriting for this nominal fee, much lower than the customary fee. You can have your own or anyone's handwriting analyzed.

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Gentlemen:—Please send me a Postal Pen fitted with point exactly suited to handwriting specimen enclosed herewith. I will pay postman $2.50 upon receipt of pen and reserve the right to return it if I am not satisfied after 30 days' use and you guarantee to refund purchase price. Write your name or a sentence in your natural uncramped style on margin or on a separate piece of paper.

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